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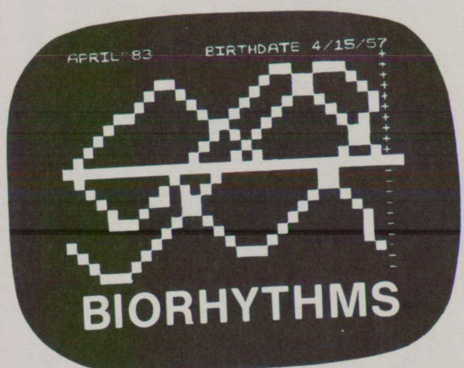

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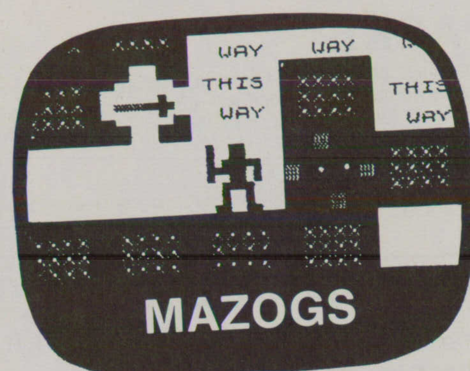

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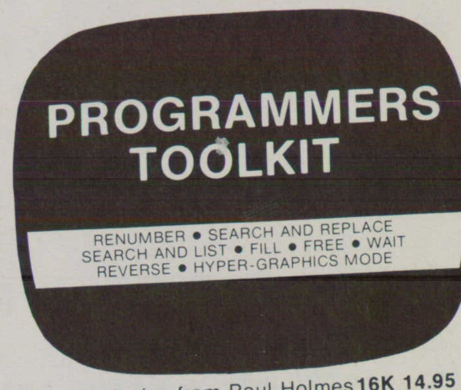

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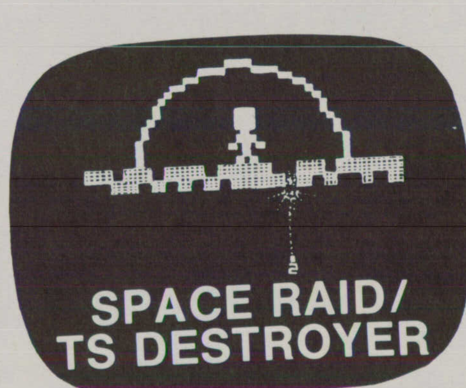

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SYNC

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letters

ROMs and RAMs

Dear Editor:

Could you please put more programs for the ZX80 with the 8K ROM in *SYNC*? All I notice is programs mainly for the ZX80 with the original 4K ROM and the ZX81.

Cris Bottjer
RR #2, Box 86-A 500 E.
Kendallville, IN 46755

Ed.—See "ROMs and RAMs" in SYNC Notes in this issue.

Memory Saving Tips

Dear Editor:

I want to call the attention of *SYNC* readers to the second paragraph on p. 129 of the 8K ROM manual: "A numerical constant in the program is followed by its binary form, using the character CHR$ 126 followed by five bytes for the number itself." This is a very inefficient way to store numbers.

Dr. Ian Logan in *SYNC* 2:2 showed some good ways to get around this inefficiency by using SGN PI and NOT PI for 1 and 0. He also used VAL "number" which saves three bytes. I suggest using one letter variables to hold numerical constants if you use the same constants more than once, or, if you use numbers that are more than four digits long. Declare these variables from the command mode so that they do not occupy program space.

Another way to save memory is to use GOTO CODE "C" instead of GOTO VAL "40". A byte saved is a byte earned. This same technique could be used for any number between 10 and 255 even though not all these characters can be accessed from the keyboard. Consider the following line:

```
500 LET N=N/100
```

You can accomplish the same thing with:

```
1 LET N=N/CODE "N"
POKE 16520,100
```

After these lines are entered, line 1 will look like:

```
1 LET N=N/CODE "?"
```

Now all you have to do is EDIT and renumber the line to 500. If you want to do several lines this way, type your program from the highest line number to the lowest so that the line you just typed will always be the first line in memory.

John Coffey
PO Box 448
Scottsburg, IN 47170

Dear Editor:

Concerning Gary Chandler's "Alien Treasure" in *SYNC* 2:4, there are several ways to increase the efficiency and speed of the program.

First, the four lines which check the bounds (132-135) can be deleted if logic is used:

```
  89 LET I$=INKEY$
  90 IF NOT I$="" THEN PRINT AT
A,B;"█"
  91 IF I$="" THEN GOTO 89
  95 IF I$="0" THEN LET A=INT (R
ND*22)
  98 IF I$="5" THEN LET B=B-(B>0
)
 100 IF I$="8" THEN LET B=B+(B<3
1)
 110 IF I$="6" THEN LET A=A+(A<2
1)
 120 IF I$="7" THEN LET A=A-(A>1
)
```

If the expression in parentheses is true, it has a value of one; otherwise the variable is not changed. Also, INKEY$ could change between lines; therefore it is always best to assign INKEY$ to a variable and then check it as in the example above.

Second, lines 81-84 indicate which direction the monster is to move. This can best be done by using SGN. Delete lines 81 and 83, and then enter:

```
82 LET X=X+SGN(A-X)
84 LET Y=Y+SGN(B-Y)
```

SGN returns -1 if the expression in parentheses is negative, 1, if positive, and 0 otherwise. Then the variables X1 and Y1 can be deleted by deleting lines 7, 8, 86, and 87.

Third, if the inspiration is great enough, the array can be deleted and a PEEK can be done to the screen location desired. Use

```
LET S$=CHR$ PEEK (PEEK 16396+256 * PEEK 16397+33* R+C+1)
```

where R is the row and C is the column. The character at that position is returned in S$.

Michael Williams
1300 DePaul Way
Virginia Beach, VA 23464

The SAVE Signal

Dear Editor:

A friend recently purchased Sinclair's 16K RAM pack, but found that the SAVE signal was drowned out by the extra noise it caused. After trying several types of filtering, I found two large foil tabs on the underside, one by the edge connector and the other next to the regulator. Connecting these with wire and rosin core solder reduced the resistance and the noise.

Raymond Fowkes
PO Box 336
Coalinga, CA 93210

Glitchoidz Report

Pseudo-Glitchoidz

From time to time readers call our attention to "Glitchoidz" they have met in entering programs. However, on closer examination we find that these are "pseudo-Glitchoidz" because the problem is not in the listing. You can avoid these "pseudo-Glitchoidz" by paying close attention to the following suggestions:

1) *Before starting to enter a program, note the* **ROM** *requirements as shown in the upper right or left corner of the first page of the article.* A 4K ROM program is for a ZX80 or MicroAce; an 8K ROM program is for the upgraded ZX80 or MicroAce, the ZX81, and the Timex/Sinclair 1000. You *cannot* enter a 4K ROM program on an 8K ROM machine or vice versa without translation. This seems to be the most common problem new users encounter. Wherever possible we give both listings. Usually 4K ROM programs can be translated to the 8K ROM, but the reverse is often difficult.

2) *Pay careful attention to the* **RAM** *requirements* before you start typing in the listing.

3) *Read the article through carefully* **before** *attempting to enter the program.* While we can sympathize with our readers' eagerness to try out the new programs, we remind everyone that the programs are usually a part of a tutorial article and that the article contains necessary information about the program.

4) *Enter the program* **as printed** *in the listing* taking into account any directions given in the article. Be sure you know what the program is supposed to do. If the program does not run, assume first that an entry error has been made and double check your entry. All the 8K ROM programs which look like the listing for "List Learning with the ZX81" in this issue are *direct printouts* from our ZX81. The program was entered on it, tested (and found to work as the author indicated), and then printed out directly from the computer with no intermediate typing stage. This does not mean that the program has no bugs, but the listing printed *did run* without bugs during the time we tested it. Occasionally some characters are not as clear as we would like due to the reproduction process, but the computer will tell you if this results in a syntax error while some experimentation may help locate the correct entry in other

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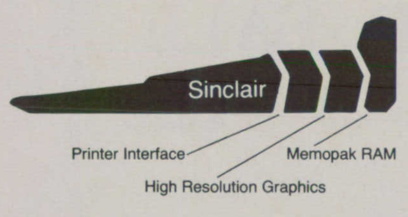

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SYNC Program Listings

Readers should note the following conventions used in the program listings in this issue:

The **ROM** and **RAM** requirements for running a given program are shown in the upper outer corner of the first page of an article. *Observe these carefully.*

NEWLINE and **ENTER** are used interchangeably.

A number may be followed by a letter to show the type: b for binary; d for decimal; h for hexadecimal.

In PRINT statements:

#: Enter a necessary space.

A (32): Use the graphic character on the A key 32 times. The underline means get the graphic on the key given in the line by whatever way your machine uses to get the graphic. An overline means use the letter in inverse form, e.g., $\overline{A}$.

INPUT: An underlined word found on the keyboard should be entered from the keyboard, not spelled out. If the keyword will not enter, hit THEN, the keyword you want, backspace and delete THEN, continue entering the line. This memory saving technique may be disregarded if you have enough RAM.

cases. The 4K ROM programs, however, are not direct printouts so there is the possibility of an error in these listings.

5) *Do not attempt to make changes in a program which does work* **before** *you understand the program as written.* Again, remember the author is trying to show you something.

6) *Be sure you know whether a given word in the program is a* **keyword**, *that is, a word entered from the keyboard in one stroke, or a word that must be spelled letter by letter.* If a keyword is used within the quotation marks in a print statement, it does not function as a command but as the word in its normal meaning. This is a memory saving technique which can be ignored if you have the additional memory.

An Alternative Display Method. 2:3.
Space Warp. 2:3.

These programs are for machines with the 4K ROM. The problems reported by some readers stem from trying to enter these programs on the ZX81. So the solution is quite simple: Do not attempt to enter a 4K ROM program on an 8K ROM machine or vice versa.

DEF. 2:4

Listing 3: Change line 110 to:
110 DIM F$(5,17)

The program will work in 2K.

ZX Destroyer. 2:4, pp. 49-50.

The author has called the following to our attention:

1) Both the 4K and 8K versions can run on as little as 2K RAM.

2) Figure 4: Line 150: Delete the set of quotation marks after the comma.

3) Figure 5: Line 20 could read PRINT "ZX DESTROYER".

4) Figure 6: 1 REM, 6th line down, last character. This is a U, not a W as it might appear.

5) Figure 8: Delete lines 10-35.

Renumbering by a USR Routine. 2:3, p. 12.

The author notes a minor correction and a possible problem.

1) The quotation marks between TAB and RND in both cases are inverse.

2) The E between V and 7 may have to be changed to 3 on some ROMs. The manual *ZX81 BASIC Programming* (1st ed., 1980) shows the same character for codes 7 and 135. The 135 is in error; it is the inverse of 7. *Ed.–Both E and 3 work on our ZX81.*

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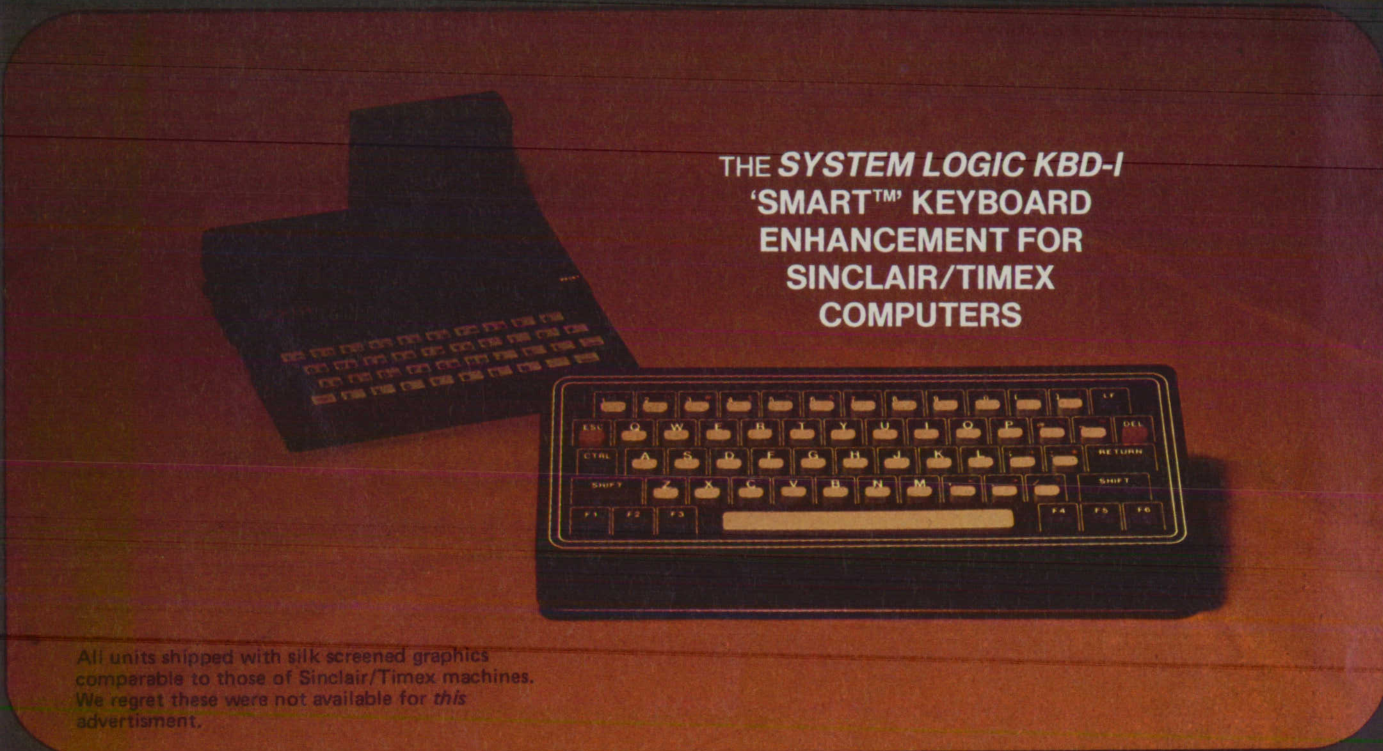

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SYNC notes

Paul Grosjean

SYNC in the Classroom

In the wake of the recent federal budget cuts in education *SYNC* has been receiving inquiries from teachers and school administrators about the Sinclair computer. The question they ask most frequently concerns the Sinclair as an alternative to the larger popular computer systems. They are interested in the fact that for the price of one of the popular systems they can get several Sinclair computers with 16K RAM packs and provide hands-on experience to several students instead of just one. For the price of several large computers a whole class could be equipped with the Sinclair computer. So a school system even with sharp budgetary constraints does not have to cut back on basic computer literacy programs; it could even initiate such programs.

Another question they often ask concerns the availability of educational software. Since the ZX80 and ZX81 were introduced to the United Kingdom market some months before they were available here, most of the educational software available is from U.K. sources. Some U.S. software suppliers have made arrangements to distribute U.K. software here.

SYNC has received a number of articles which suggest some of the educational uses of the Sinclair computers, and we have gathered some of these for our theme section "SYNC in the Classroom." These articles deal with a variety of levels from pre-school up.

Two major characteristics show up in the articles we have received. First, the main focus of most is math. Perhaps this is natural; after all, a computer does compute. We will be using some of these in future issues. Second, many articles use the computer as a substitute for a pencil and scratch paper. Certainly this is one use, and it is an important one where the computations are extremely lengthy and tedious. However, it seems hardly worth the trouble to load a tape to do something that a pencil and paper will do more quickly. Since such programs are not difficult to write, they tend to appear first.

At the present the computer seems to be more of a novelty in the classroom than an integral tool in the learning process. There are three main obstacles to classroom computer use. First, the most serious obstacle is that we do not yet have enough teachers with computer training to use the computer as a teaching tool. It seems frequently that the computer is assigned to the math department which is expected to either have or get the expertise to use it. Like other equipment which requires some study and work to use the computer may be in danger of being relegated to the closet when the enthusiasm of the administration for getting on the computer bandwagon wears off.

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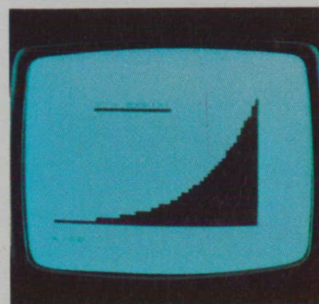

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Second, some teachers are afraid of it and will resist its use. This is partly because some students are already far ahead of them in computer mastery, and we adults have a hard time accepting the fact that an elementary school student can know more than we do about a subject that everyone *knows* is difficult to master.

Third, some schools restrict the use of their computers to advanced students. This is unfortunate because the idea is encouraged that computers are only for "special" students, not for "ordinary" students. Above all, the computer is not integrated into the total school curriculum as a tool with a contribution for each area.

The serious use of the computer in education depends upon having teachers trained to use it in their particular fields, software exploiting the computer's capability for interaction with the student, and an openness to a new tool for teaching and learning.

How is the computer being used in your local school system?

ROMs and RAMs

Readers have requested that we publish 8K ROM translations of the programs we published before the 8K ROM was introduced. We are including some of these translation in "8K ROM Updates" elsewere in this issue. We have also been asked to publish programs for the ZX80 with the 8K ROM.

We specify the ROM and RAM requirements on all programs and articles where these are necessary, but we do not specify the machine as such.

The 4K ROM programs will work on the ZX80 and the MicroAce; The 8K ROM programs, on the ZX81 and the ZX80 with the 8K ROM. However, since the SLOW mode cannot be accessed on the ZX80 with the 8K ROM, programs which must be run in SLOW mode require some slight modification. The SLOW mode functions to allow the viewer to see the display change. Usually the action graphics routines have two basic parts: 1) putting a new picture on the screen, and 2) taking it off. On the ZX80 with the 8K ROM you can use a PAUSE between these two parts to allow you to see the change. For example,

```
10 LET J=1        Initialize
20 LET I=1        variables
30 PLOT I,J       "Prints" picture
40 UNPLOT I,J     Removes picture
50 LET J=J+1      Adjusts variables for
                  new picture
60 GOTO 30        Loop back to "print"
                  new picture
```

For the ZX80 with the 8K ROM you would add

35 PAUSE (number, e.g., 10)

The number determines the length of the PAUSE. In the U.S. 60 equals one second; in the U.K. 50 equals one second.

Generally our authors write their programs on one specific machine. We request our authors to supply the listings or modifications necessary for the users of the other ROMs and machines; on occasion we modify or translate a program. The ROM in parentheses indicates such a translation or adaptation.

Since 8K ROM programs are virtually identical we have not made separate listings for the ZX80 users.

Some readers have also asked concerning the RAM designations. These RAM designations (usually in the upper right or left corner of the first page of an article) do not refer to the length of the program, but to the amount of RAM your machine must have to run the program. Many programs designated 16K require much less than 16K RAM, but, since most users and authors have 1K, 2K or 16K RAM, we do not specify intermediate RAM levels. When a RAM designation appears in parentheses, we mean that modifications of the basic program are provided for use with that much RAM.

try this

4K ROM

Enter the following program.

```
10 FOR A=38 TO 63
20 FOR B=38 TO 63
30 FOR C=38 TO 63
40 PRINT  CHR$(A);CHR$(B);CHR$(
C);"#";
50 NEXT C
60 NEXT B
70 NEXT A
```

Hit RUN and NEWLINE. When the screen is full, press NEWLINE, CONTINUE, and NEWLINE. Repeat this process until you have completed the sequence. The same program can be entered on the 8K ROM, and you might want to add the line: 45 SCROLL. Our thanks to:

A. Dan Klyver
29 Old Stagecoach Rd.
Weston, CT 06883

8K ROM

Enter the following program. For the graphics, use the graphic on the key indicated the number of times in ():

10 E (1), 7 (10), R (1).
20 5 (1), 10 spaces, 8 (1).
30 W (1), 6 (10), Q (1).
50 10 spaces, A$, 10 spaces.

```
 10 PRINT AT 9,10;"▛▀▀▀▀▀▀▀▀▀▜"
 20 PRINT AT 10,10;"▌          ▐"
 30 PRINT AT 11,10;"▙▄▄▄▄▄▄▄▄▄▟"
 40 INPUT A$
 50 LET A$="          "+A$+"          "
 60 LET B=LEN (A$)-10
 70 FOR X=1 TO B
 80 PRINT AT 10,11;A$(X TO X+9)
 90 NEXT X
100 GOTO 70
```

Be sure that you are in SLOW mode, hit RUN and ENTER. After the display appears, type in your name and press ENTER. Observe the results. Our thanks to:

Mark Kluth
143 Humphrey Circle
Shawano, WI 54166

Enter the following program very carefully. Any underlined letters indicate that you should use the graphics on that key. The underlined tokens and keywords should be entered directly from the keyboard and not spelled out. If a given keyboard entry will not enter, hit THEN, the keyword, backspace and delete THEN, go forward again and continue typing in the program.

```
10 REM <>E£RND1£#<>DT3<>Q#O<>
FAST VAL 11#LN P?AT <> LPRINT <>
Q##<>7( CONT T3<>Q#O<> FAST VAL
11#LN P?AT <> LPRINT <>Q##<>F( C
ONT /ASN
20 PRINT AT 11,31;"#"
30 LET S=USR 16514
```

After entry is complete, SAVE on cassette. Then be sure that you are in FAST mode, press RUN and ENTER and watch what happens. Our thanks to:

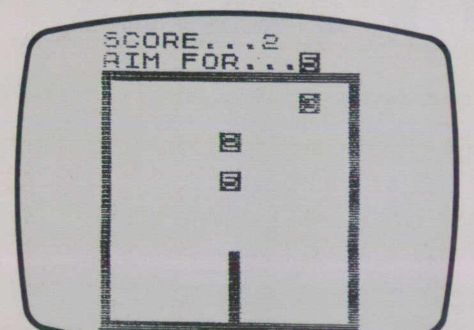
Scott Laska
2205 Calumet Dr.
New Holstein, WI 53061

Just for Fun

Generally *SYNC* prefers articles in some depth to help you get more out of your computer. However, we receive many short programs that illustrate a point, demonstrate a technique, or show something the reader has found interesting. "Just for Fun" shares these programs with you. If you learn something, great. If you have some fun, great. If you have some that you want to share, send them to: Just for Fun, SYNC, 39 E. Hanover Ave., Morris Plains, NJ 07950.

Zap

M. Hampson



You are a laser zapper on a space cruiser on routine patrol when suddenly your ship is under attack. Each of the attackers is assigned a number, and each zapper is assigned a target. A target number appears on your screen, and you must destroy that target and only that one. Your performance as a zapper is measured by the score you achieve. Each assigned target hit is worth one point. Your rating as a zapper is the score you achieve. The higher the score, the higher your rating will be. If you shoot at a target you have not been assigned, you get no points. Furthermore, you will have wasted a shot and the next assigned target appears.

You control your laser movement with the 5 key for left and the 8 key for right. Press 0 to fire.

Enter the program, put the computer in SLOW mode, and hit RUN and ENTER.

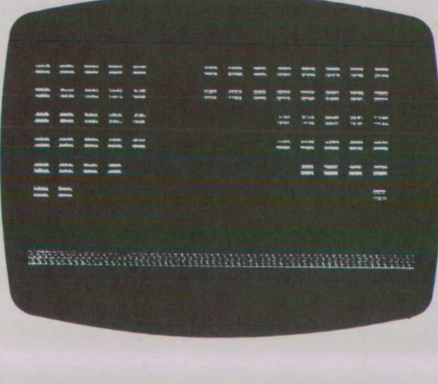
```
 10 FOR Z=VAL "0" TO VAL "25"
 11 PLOT Z,VAL "0"
 12 PLOT Z,VAL "25"
 13 PLOT VAL "25",Z
 14 PLOT VAL "0",Z
 15 NEXT Z
 20 LET P=VAL "1"
 30 LET S=VAL "0"
 40 PRINT AT VAL "7",P-P;"SCORE
..";TAB P-P;"AIM FOR..."
100 FOR N=157 TO 165
101 LET Q=INT (RND*11)*2+1
102 UNPLOT Q,INT (RND*20)+3
103 PRINT CHR$ N
104 PRINT AT 8,10;CHR$ N
105 FOR Z=0 TO 25
110 UNPLOT P,1
120 LET P=P+(INKEY$="8")-(INKEY
$="5")
130 PLOT P,1
140 IF INKEY$<>"0" THEN GOTO 15
5
145 IF P=Q+1 OR P=Q+2 THEN LET
S=S+1
150 FOR Z=2 TO 24
151 PLOT P,Z
152 NEXT Z
153 FOR Z=2 TO 24
154 UNPLOT P,Z
155 NEXT Z
156 PRINT AT 7,8;S
160 NEXT N
```

Blaster

M. Hampson

In Blaster the screen displays a field showing a wall of 7 courses of equals signs. Your blaster, which is on continuous fire, is indicated by an asterisk. You have 200 shots to clear away the wall. The movement of your blaster is automatically to the right; to move it to the left you must press the 1 key. The score, showing the total number of hits, is displayed at the end.

Type in the program without using your RAM pack. Put the computer in SLOW mode, hit RUN and ENTER.



Graphics notes:
Line 4: Inverse equals sign (16).
Line 6: Inverse space (16); S (16).

```
  1 LET N=0
  2 LET B=501
  3 FOR Z=0 TO 6
  4 PRINT AT Z,0;"================"
  5 NEXT Z
  6 PRINT "                ","SSSSSSSSSSSSSSSS"
  7 LET P=8
  8 LET V=PEEK 16396+256*PEEK 1
6397
 10 LET B=B-1
 20 IF B=0 THEN GOTO 200
 30 LET P=P-1+(INKEY$="")*2-(P=
15)+(P=0)
 40 POKE 120+V+P,151
 60 FOR Z=120+V+P TO V STEP -17
 70 IF PEEK Z=148 THEN GOTO 110
 80 POKE Z,151
 81 POKE Z,128
 90 NEXT Z
100 GOTO 10
110 POKE Z,128
120 LET N=N+1
130 IF INT (N/112)<>N/112 THEN
GOTO 10
140 GOTO 3
200 PRINT "YOUR SCORE ";N
205 PAUSE 50000
210 CLS
215 RUN
```

Catch 25, or Playing Left Field

M. Hampson

Your catching glove (or cup or whatever you want to catch with) appears as a U. The ball comes down and you must move to catch it in your glove. You move into catching position by using all the arrow keys so this requires simultaneous four finger coordination. When you catch the ball, a shift in graphics to the asterisk indicates a successful catch. Your score, which is the total of successful catches, is displayed in the top center of your screen throughout the game.

Type in the program. Put your computer in SLOW mode, hit RUN and ENTER.

Graphics notes:
Line 120: a period.
Line 150: the letter U.
Line 200: an asterisk.

```
 20 LET Q=VAL "10"
 30 LET R=Q
 40 LET S=Q-Q
100 FOR Z=Q/Q TO VAL "25"
105 LET P=INT (RND*VAL "10")
110 FOR L=Z/Z TO VAL "17"
120 PRINT AT L,L+P;" ";AT L+Z/Z
L+P+Z/Z;"."
130 PRINT AT Q,R;" "
140 LET Q=Q+(INKEY$="6")-(INKEY
$="7")
141 LET R=R+(INKEY$="8")-(INKEY
$="5")
150 PRINT AT Q,R;"U"
160 IF L+Z/Z=Q AND L+P+Z/Z=R TH
EN GOTO VAL "200"
170 NEXT L
180 NEXT Z
190 STOP
200 PRINT AT Q,R;"*"
210 LET S=S+Z/Z
220 PRINT AT Z/Z,VAL "11";S
230 GOTO VAL "180"
```

M. Hampson, 7 Hereford Dr., Clitheroe, Lancs BB7 1JP, U.K. Reprinted from *The Ultimate Magazine* with permission.

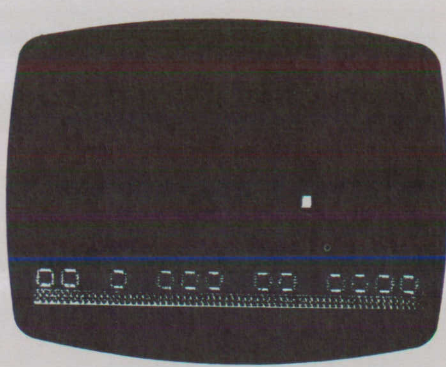
Neil Dewhurst, 2 Chesterbrook, Ribchester, Nr. Preston, PR3 3XT, U.K. Reprinted from *The Ultimate Magazine* with permission.

Bombs Away!

Neil Dewhurst

Your high speed bomber appears at the top of the display as the inverse and moves from left to right. Your targets appear at the bottom of the display as inverse O's. Press any key to drop a bomb at any time. Each time the plane makes a pass over the target area, it drops down closer to the targets. The aim of the game is to hit all the O's before the plane gets too low to make another pass.

Enter the program, put your computer in SLOW mode, press RUN and ENTER.



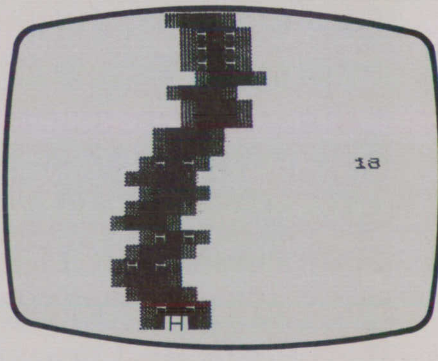
Graphics notes:
6: inverse space (16).
10: inverse O (16); S (16).
120, 310: inverse
140, 280, 400: inverse spaces.
145: Q.

```
   5 FOR Z=VAL "1" TO VAL "8"
   6 PRINT "████████████████"
   7 NEXT Z
   8 CLEAR
   9 LET B=VAL "0"
  10 PRINT "████████████████","▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
 100 FOR P=VAL "0" TO VAL "7"
 110 FOR Q=0 TO 15
 120 PRINT AT P,Q;"█"
 125 IF B THEN GOTO 140
 130 IF INKEY$="" OR P=7 THEN GO
TO 150
 131 LET R=P
 132 LET S=Q
 133 LET B=1
 140 PRINT AT R,S;"█"
 141 LET R=R+1
 142 LET S=S+1
 143 IF S>15 THEN LET S=0
 145 PRINT AT R,S;"▟"
 146 IF R=8 THEN GOSUB 400
 280 PRINT AT P,Q;"█"
 290 NEXT Q
 299 NEXT P
 300 FOR Q=0 TO 15
 310 PRINT AT P,Q;"█"
 320 IF 128<>PEEK (PEEK 16398+25
6*PEEK 16399) THEN STOP
 330 NEXT Q
 340 STOP
 400 PRINT AT R,S;"█"
 410 LET B=0
 420 RETURN
```

Grand Prix

Neil Dewhurst

You have just entered the 1K Grand Prix. The black-topped track scrolls as you drive your white "H" car toward the finish line. You steer by the Z and M keys. You must avoid hitting the parked cars and running off the road. If you do crash, the race ends and your odometer



reading appears. Each line scrolled adds one to your reading. The aim of the race is to drive as many miles as possible.

Enter the program, put your computer in SLOW mode, press RUN and ENTER

Graphics notes:

Line 40: Inverse H.

Line 50: Inverse space.

Line 60: A; inverse space; A; inverse space.

```
   5 LET F=VAL "-12"
  10 LET P=VAL "10"
  20 LET R=VAL "7"
  30 PRINT AT 10,P;"H"
  40 LET G$="█"
  45 LET F=F+1
  50 IF RND>.3 THEN LET G$="█"
  55 SCROLL
  60 PRINT TAB R;"▒";G$;"█";G$;"
▒";AT 9,P;" " AND F<=0;"█" AND F
>0;AT 10,P;
  70 IF R>2 THEN LET R=R-2*RND
  80 IF R<10 THEN LET R=R+2*RND
  90 LET P=P-(INKEY$="Z")+(INKEY
$="M")
 100 IF PEEK (PEEK 16398+256*PEE
K 16399)=128 OR F<0 THEN GOTO 30
 110 PRINT TAB 20;F
```

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8K ROM
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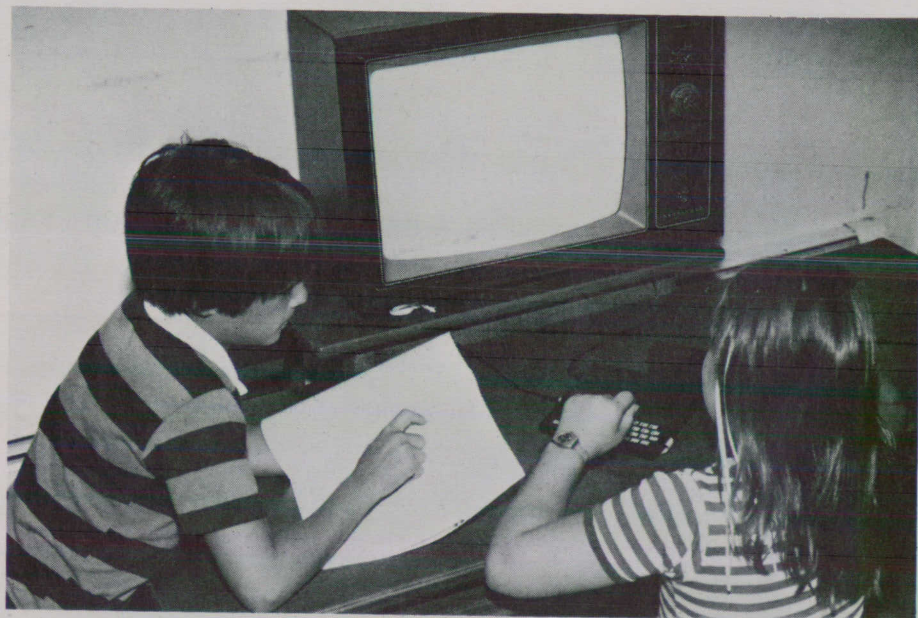
perceptions

David B. Ornstein

Parser Routines

This article is the third in a series discussing the ZX81 Parser. Since the first two articles (*SYNC* 2:3 and 2:4) may have been a bit too abstract for some readers, I hope this discussion will pull the previous articles together.

In the first article I covered the basic concepts common to all parsers, and in the second article I described the implementation of the parser in the 8K Basic ROM: the character fetch routines, the CLASS tables, and the executive routine that was responsible for controlling overall operations. In this article we will look at some of the routines that are called by the executive to perform actual operations. These operations include, but are not limited to, PLOTting a point on the screen, PRINTing a character on the screen, and executing a GOTO statement.



RUNning a Program in Basic

Before taking up the details of any particular command, let us review the method used by Basic to RUN a program. In the parser's executive routine a pointer must be passed to the line it is to execute. This pointer is passed to the exec(utive) in the system variable CH-ADD. A loop (at 066Ch in the new ROM) is responsible for keeping track of what line in the program we are currently executing and where it is stored in the computer's memory.

The way the computer stores a program in its memory is seen in Figure 1 which represents a single program line. The first two bytes of the line contain the line number of the represented line. These bytes are stored in MSB/LSB (Most/Least Significant Byte) order. This is the opposite of the standard practice with a Z80.

Figure 1: A Line Representation.

1	2	3	4	Text of Line	ENTER

The next two bytes hold a standard Z80 LSB/MSB 16-bit representation of the length of the line, including the ENTER (NEWLINE) at the end. When the program has more than one line, the computer is responsible for keeping the records that represent each line of the program in numerical order.

With the information supplied with each line, the computer has enough data to effectively "walk" through the program from one line to the next. This is accomplished by adding to the address of the first byte of the text in the line, and the length of the line, as specified in the two length bytes. The result of this calculation is the address of the next line in the program. Thus, the Run-Executive, as it will be referred to later, must perform only simple operations such as addition to RUN a program. A basic outline of the operations performed by the Run-Executive is as follows:

1) Load a variable (called NXTLIN) with 16509. This is the address of the first line of the program.

2) Set CH-ADD equal to NXTLIN.

3) Call the parser to execute the line.

4) If there are any errors currently logged, then stop, and report them, else,

5) If the BREAK key is depressed, stop with a D report code, else,

6) Add to NXTLIN the length of the current line.

7) Go back to step 2.

Figure 2 gives the code for the Run Time Executive. Take a moment now to study it to get a general idea of what is transpiring. The essential facet of this routine is that, when a command handler is called by the parser, it can modify the NXTLIN pointer; this is, in fact, how a GOTO statement works. The destination of the line number (i.e., 100 in GOTO

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Figure 2. Listing of the Run Time Executive.

```
NEXT-LINE:
LD     (NXTLIN), HL
EX     DE,HL
CALL   TEMP-PTR              ;$004D
CALL   LINE-RUN              ;$0CC1
RES    1,(FLAGS)
LD     A, 11000000b
LD     (X-PTR),a
CALL   X-TEMP                ;$14A3
RES    5,(FLAGX)
BIT    7,(ERR-NR)
JR     Z,STOP-LINE
LD     HL,(NXTLIN)
AND    (HL)
JR     NZ, STOP-LINE
LD     D,(HL)
INC    HL
LD     E,(HL)
LD     (PPC),DE
INC    HL
LD     E,(HL)
INC    HL
LD     D,(HL)
INC    HL
EX     DE,HL
CALL   BREAK-1               ;$0F46
JR     C,NEXT-LINE
```

```
LD     HL,(ERR-NR)
BIT    7,(HL)
JR     Z,STOP-LINE
LD     (HL),$0C

STOP-LINE:
BIT    7,(PR-CC)
CALL   Z,COPY-BUFF
LD     BC,$0121
CALL   LOC-ADDR              ;$0918
LD     A,(ERR-NR)
INC    A
JR     Z,REPORT
CP     $09
JR     NZ,CONTINUE
INC    BC

CONTINUE:
LD     (OLDPPC),BC
JR     NZ,REPORT
DEC    BC
CALL   OUT-CODE              ;$07EB
LD     A,$18
RST    10
CALL   OUT-NUM               ;$0A98
CALL   CURSOR-IN             ;$14AD
JP     DISPLAY-6             ;$04C1
```

100) is evaluated, the address of that line is found, and then the calculated address is loaded into NXTLIN.

STOP

The STOP command is, as far as the driver code is concerned, the most elementary of all commands. The command handler for STOP is:

```
STOP:  RST 8
       .byte $08
```

The RST 8 routine will, when called, simply load into ERR-NR the byte given after the RST 8 instruction. In this case, the byte is a 08h. This number is the number-of-the-error-to-cause -1. If you review the code for the Run-Executive, you will see that, at the end of every line, it checks the ERR-NR byte. If the byte is not FFh, then the Run Executive stops and reports an error.

NEW

The NEW command is also a very simple command. When the computer is powered on, the BC register pair is loaded with 7FFFh, and a jump is made to the initialization routine. The initialization routine then fills every byte of memory from BC down to 4000h with a 2. It then goes back and decrements by 1 each of the aforementioned memory locations. As the computer decrements each location, it checks to be sure that the value obtained after the decrement was a 1. If it was not, then the computer has found the end of available memory, and this address plus 1 is loaded into RAMTOP.

The effect of the NEW code is simply this: load BC with RAMTOP, decrement BC, and fall through to the initialization routine.

GOTO

As mentioned earlier, the only steps that the GOTO command handler must execute to accomplish its purpose are: 1) get the destination line number, 2) find the address of the specified line, and 3) load this value into NXTLIN. Let us examine each of these individually.

First, there is the matter of obtaining the line number specified as the argument to the GOTO. Reviewing Perceptions in the last issue of *SYNC* (which you, of course, have on the desk in front of you), find the entry for GOTO in the Offset Table *SYNC* 2:4, Listing 2). You will see that the first type specified was a CLASS-6 Entry and that CLASS-6 specifies an Integral-Expression.

As the parser examines the line in which the GOTO occurred, it called CLASS-6 to parse out the expression. CLASS-6 left the value of this expression on the calculator stack. A subroutine FIND-INT (at 0EA7 in the new ROM) will remove a value from the top of the calculator stack and round it down to 16-bit integer in the BC register pair. If the number is outside of the 0.65535 range, then the FIND-INT routine gives Report-B.

Now we have the required argument for the GOTO statement. Next we must, using this number, find the address of the Basic line that it specifies. This type of search routine is about as common as a parser, and the designers of the Sinclair ROM, fearing that they might fall short of expectations, decided to incorporate just such a routine into the 8K ROM. The routine, located at 09D8h, takes a line number in the HL register pair, and returns the line number in BC, and the address of the requested line (or that of the next one, if no such line exists) in HL.

Since the first two stages of the GOTO have been accomplished, the last stage would appear to be easy. Indeed it is. All we need do now is to take the address returned by the search routine in the HL register pair, and place it in NXTLIN. The GOTO command handler then returns, and the Run-Executive continues at the new line without even the slightest sound of discontent.

CONT

If you look at the code for the Run-Executive very closely, you will see that, when an error is encountered, the current line number is loaded into a system variable called OLDPPC. This is the line number to which CONT continues. There is only one detail. If we go back to the same line at which the error occurred, and the cause of the error was only a STOP statement, then as soon as we CONTinue, we will re-execute the STOP. The code in the Run-Executive is smart enough to detect this situation. Whenever an error is going to be reported, the error number is compared with 09 (STOP). If the error number is 09, then the current line number is incremented before it is saved in OLDPPC.

With that little detail out of the way, I can now tell you how CONT works: it loads HL with OLDPPC and jumps to step 2 of GOTO. Simplicity.

REM

Once again we find that the advantages of having a well-written parser at our disposal are incredible. The command handler for REM is simply a RETurn instruction. If you consider this for a moment, you will see the ease with which it works in this system. When the RET is executed, the Run-Executive simply continues by adding the length of the line with the REM in it to the address of said line. The Run-Exec then continues normally at the NXTLIN.

We hope that this discussion of a few of the concrete command handlers will help you to understand better the way a computer, your computer, operates.

Until next time, same relativistic time period, same non-Euclidian universe.

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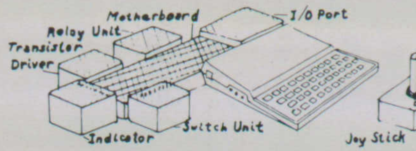

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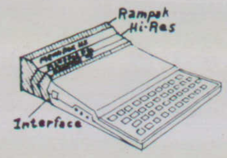

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List Learning with the Sinclair

James John Hollandsworth

Introduction

The Sinclair computers can be effective learning aids if the student or teacher has the software to set up learning situations. A program to assist in the learning process should meet several criteria. First, it should be self-explanatory. Second, it should have different modes of operation. Third, it should be practical as a learning tool. Fourth, it should be usable for various kinds of content. Fifth, it should be enjoyable to use. The List Learning Program discussed in this article meets these critera. Let's look at this program and how you can use it to increase your learning or to help others over some of the hurdles of list learning.

John James Hollandsworth, Box 163, Montcoal, WV 25135.

Entering the Program

Type in the entire program in Listing 1. I would strongly urge saving your work frequently. Spending three hours at your Sinclair and having a power interrupt can be frustrating. After you have typed in and saved the entire program, congratulate yourself for your endurance!

Next, decide on the content for the list you want to use with the program. This list must consist of two columns in which the items to be memorized are paired. I originally designed the program for the list of the 92 natural elements and their symbols (this list can be found in any encyclopedia, usually under "The Periodic Law" or in any chemistry textbook). This is, of course, very valuable for anyone taking chemistry, but many other lists are possible, e.g., a list of states and abbreviations or capitals or other information.

Loading the Lists

When you have your two-column list prepared, enter it by following the steps listed below. For the sake of illustration, I will use the list of the 92 elements, so you will have to make the appropriate changes for your own list.

If you put your computer in FAST mode for entering the program, be sure to return to SLOW mode for entering your lists in order to avoid the screen flicker when the program starts running by itself later.

1) To get into the utility list loaded program, type GOTO 1000. NEVER, NEVER, NEVER, TYPE RUN in this program or you will lose your list.

2) A menu of the utility program's functions will appear. Since you wish to load a new list, type in 1.

3) Input the title of your program which will appear when the program begins, e.g., "LEARNING THE ELEMENTS SYMBOLS."

4) Type in the title of the first class of items in your list. This should be the class with the longest strings if applicable. In the list of elements the names of the elements are obviously longer than the symbols so you would type in "ELEMENT–". If your list has two classes of items that are about the same (such as states and their capitals), it does not matter which is first.

5) The program now needs to know how many characters are in the longest word in the first class list. In the elements list this is 12.

6) Enter the name of the second class ("SYMBOL–") and the length of the longest items (2).

7) Enter the number of items in your list (92 elements).

8) Now a display of everything you have typed in appears. If you have made a mistake, type N to start over.

9) To start entering the actual list, type Y. At the bottom of the screen a prompt will appear, e.g., "ELEMENT–". Type in the first element "HYDROGEN," and it will be displayed beside the prompt which will then scroll up to make room for the "SYMBOL–" prompt. Type in "H", and the element prompt will reappear. Continue typing in the items until you have finished your list. If you see a mistake in something you have typed in, just finish the list.

10) After you finish typing in everything, the program will go into a review. The first pair of items will be displayed (ELEMENT-SYMBOL). If the pair is correct, hit ENTER to review the next pair. If either is incorrect, hit the X key and ENTER. The prompt for your first item will appear (ELEMENT–); type the entry in correctly. The prompt for the second item will appear (SYMBOL–); type in this entry correctly. The program then moves on to the next pair until all have been reviewed.

11) The program asks for the name that the program will be SAVEd under.

12) At this point you will return to the menu. If you want to review the list again to make changes or to doublecheck, type in 2. If you want to change the SAVE name, type in 3. If for some reason you want to start over, type in 1. To SAVE the program, hook up your recorder and position your tape where you wish to start. Hit 4 and ENTER and immediately hit the RECORD button. (If you used the elements list, the program will take 3:15 minutes to SAVE.)

13) After you have SAVEd the program, the utility program will put you into the actual learning program. Whenever you need to use the utility program again, simply type BREAK during a PAUSE and type GOTO 1000.

Now you can enjoy the fruits of your labor, but you must read the next section.

Using the Learning Program

When you LOAD the program or get out of the utility program by SAVEing, the list learning part of the program automatically starts. This prevents someone from being in a position to RUN it by accident.

The title of the list appears at the top of the screen, and a request to type in your name appears below it. This allows the computer to address you personally. Though this routine may be considered a frill, users may enjoy the feeling of a more personal interaction with the computer in a learning situation.

Program Modes

After typing in your name, you will see a program mode menu appear on the screen. This menu gives you four modes for using the lists you have entered.

Mode 1: Reviewing the List

The first mode is akin to running your finger down a list as you try to memorize it. However, when the computer does the moving, the situation is more involving and generally more effective. The program goes through the list in this manner: It flashes an item from the first list, pauses to allow the user time to remember the corresponding item from the second list, and then displays the second item. This procedure is more stimulating and helpful as a learning technique than simply displaying the pair of items simultaneously.

The speed of the display depends on the speed number you type in: 0 is the fastest and 9 is the slowest.

After you have gone through the items in the first list, the computer begins again with the items in the second list. When you have completed this list, the first list will again appear and the process endlessly repeats. So whenever you want to go back to menu, press the Q key. Sometimes you must press twice or thrice before the program responds. Entering Q will also exit you from modes 2 and 3.

Mode 2: Practice Drill

In the practice drill the program will randomly select 15 items from the first list and ask for the corresponding match. Then it will reverse the lists and again ask for the match. If your list has 40 items or more, the practice drill executes a special feature. Each time the drill is called up, an array E$ is used as a tally. If you answer a question correctly, the program "makes a note of it" and will not ask that item pair again. This tally is erased each time the practice drill mode is entered. Also, you will notice that, when you do not give a correct match, the program pauses longer after the correct answer is displayed. The additional time to look at the correct answer is a study feature. At the end of thirty questions, the number of correct answers is displayed.

Mode 3: Speed Quiz

In this mode you are given items from the longer list and asked for the matching item from the shorter list. You try to get as many of the pairs as possible in sixty seconds. This is the reason for making the second column shorter so that more questions can be answered in one minute. The computer gives you one point for each correct answer and penalizes you one point for each incorrect answer. If you have no idea what the answer is, hit ENTER. Inputting a null string in this way will move you on to the next question without penalty. After sixty seconds the program stops and displays your score.

Mode 4: Fond Farewell

The final mode is simply a "Fond Farewell" to the user. Instead of STOPping, the program will PAUSE about seventeen seconds and restart at the beginning. The purpose of this procedure is to prevent the user from accidentally RUNning it. This is also an ideal place to BREAK the program if you need to LIST it, modify it, or get into the utility program.

Program Features

This program provides you with a base for a custom program of your own. Not only can you use it for any two column list learning that you want, but also, with over 230 lines, you can tinker, change, and modify to your own satisfaction.

Subroutines are placed at the beginning of the program for faster execution. Most of the subroutines are only a line or two, but they do save memory. Let's note the following subroutines especially.

Subroutine 10 is used to pick a random number and set up the screen. If a random number is not needed (as in the review mode), it is GOSUB 12.

Subroutine 15 is used in the review mode to test whether the user wants to exit. In modes 2 and 3 it is GOSUB 16.

Subroutine 20 is used in the first three modes in the initial display.

Subroutines 25 and 30 are used in the drill mode. The 8K ROM has an internal timer at memory locations 16436 and 16437 which PAUSE uses. It decrements every time a frame on the TV is displayed, i.e., sixty times a second. To time the speed drill, I POKEd the values to 0. The timer then starts counting backwards, beginning at 65536 and losing 60 a second. After each input, the computer PEEKs the value to see if it has passed 61936 which is the 60 second value. Notice that PAUSE cannot be used during this time because it also POKEs the value.

Routines such as in lines 657-659 are found in modes 2 and 3. These routines are needed to add spaces to a user input because the input has to be the same length as the answer in the array for the two to be compared.

The Variables

To facilitate user changes, the list of variables used in the program is as follows:

T$: The title of the program.

C$: The name of the user entered at the beginning.

M$: The name of the first class of items.

N$: The name of the second class of items.

L1: The length of the longest item in the first list.

L2: The length of the longest item in the second list.

A: The user menu input; also used in FOR-NEXT loops.

Z: The review speed.

TOT: The total number of items in the list.

U: Score for the drill and speed quizzes.

F1: Flag used in the utility program.

F2: Flag-1 if the list is fewer than 40 items.

D$: Generally used for user inputs.

L$: SAVE name.

P: 16437; used in POKE after PAUSE statements.

Q: 255; used in POKE after PAUSE statements.

A$(?,?): Array used for first list items; dimensioned as A$(TOT,L1).

B$(?,?): Array used for second list items; dimensioned as B$(TOT,L2).

E$(?): Array used to keep track of correctly answered items in drill mode; dimensioned as E$(TOT).

Final Observations

If you SAVE the program first without any list entered, it is ready for use with any list. Of course, after you have entered a list, the program and your list should be SAVEd together. You can have as many custom programs as you need. Changes in the program may broaden its use in your particular situation. *SYNC* would be interested in hearing from readers concerning their use of this program. ■

```
   1 REM LIST LEARNING BASE PROG
RAM BY JAMES JOHN HOLLANDSWORTH,
 BOX 163, MONTCOAL, WV 25135--PH
ONE 304-854-2237
   3 REM REVISED 8-4-82
   4 REM  TO RUN PROGRAM TYPE
GOTO 100
   5 REM TO MANIPULATE LIST TYPE
 GOTO 1000
  10 LET B=INT (RND*TOT)+1
  12 CLS
  13 PRINT "---------HIT Q FOR ME
NU----------"
  14 RETURN
  15 LET D$=INKEY$
  16 IF D$="Q" THEN GOTO 990
  17 RETURN
  20 PRINT "IN THIS MODE, ";C$;"
."
  21 RETURN
  25 PRINT "YOU SAID IT WAS ";D$
;"."
  26 RETURN
  30 PRINT TAB 8;"YOU ARE CORREC
T."
  31 RETURN
 100 PRINT T$
 104 PRINT AT 5,0;"PLEASE TYPE I
N YOUR NAME."
 110 INPUT C$
 115 CLS
 120 PRINT "HELLO, ";C$;"."
 125 PRINT "I WILL HELP YOU LEAR
N SOME ";M$;"S AND THEIR ";N$;"S
.  THE MENU OF THINGS I CAN DO I
S:"
 126 PRINT
 130 PRINT "1. REVIEWING THE LIS
T"
 131 PRINT "2. PRACTICE DRILL"
 132 PRINT "3. SPEED QUIZ"
 133 PRINT "4. EXIT THE PROGRAM"
 134 PRINT
 135 PRINT "PLEASE TYPE IN THE N
UMBER OF     YOUR CHOICE, ";C$;".
"
 140 INPUT A
 142 IF A<>1 AND A<>2 AND A<>3 A
ND A<>4 THEN GOTO 140
 145 CLS
 150 GOTO A*200
 200 PRINT "REVIEWING THE LIST--
"
 205 GOSUB 20
 210 PRINT "I WILL DISPLAY A ";N
$;" ON THE SCREEN, PAUSE, THEN D
ISPLAY THE ";M$;".  AFTER REVIEW
ING ALL ";TOT;" I WILL SWITCH TO
 SHOWING THE ";M$;" FIRST.  TYPE
 A NUMBER FROM 0 TO 9--0 BEING A
 VERY FAST REVIEW AND 9 THE SLOW
EST."
 215 INPUT Z
 217 IF Z<0 OR Z>9 THEN GOTO 215
 220 FOR A=1 TO TOT
 225 GOSUB 12
 230 PRINT AT 10,8;B$(A);" ";
 235 PAUSE 20+Z*10
 236 POKE P,0
 240 GOSUB 15
 245 PRINT A$(A)
 250 PAUSE 20+Z*10
 251 POKE P,0
 255 GOSUB 15
 260 NEXT A
 265 FOR A=1 TO TOT
 270 GOSUB 12
 275 PRINT AT 10,8;A$(A);" ";
 280 PAUSE 20+Z*10
 281 POKE P,0
 285 GOSUB 15
 290 PRINT B$(A)
 295 PAUSE 20+Z*10
 296 POKE P,0
 300 GOSUB 15
 305 NEXT A
 310 GOTO 220
 400 PRINT "PRACTICE DRILL---"
 405 GOSUB 20
 410 PRINT "I WILL GIVE YOU 15 "
;M$;"S IN SUCCESION.  YOU TYPE I
N THEIR ";N$;"S.  THEN I WILL GI
VE 15 ";N$;"S AND YOU TYPE IN TH
E ";M$;"S.  PRESS ENTER TO START
."
 412 LET U=0
 415 INPUT Z$
 419 IF F2 THEN GOTO 435
 420 FOR A=1 TO TOT
 425 LET E$(A)=CHR$ 0
 430 NEXT A
 435 FOR A=1 TO 15
 440 GOSUB 10
 445 IF E$(B)="X" THEN GOTO 440
 447 PRINT AT 9,0;"TYPE IN THE "
;N$;" FOR--"
 450 PRINT AT 10,8;A$(B)
 460 INPUT D$
 462 GOSUB 25
 465 GOSUB 16
 470 IF LEN D$=L2 THEN GOTO 475
 472 LET D$=D$+" "
 473 GOTO 470
 475 IF D$=B$(B) THEN GOTO 490
 477 PRINT TAB 8;"NO, IT IS ";B$
(B);"."
 478 PAUSE 200
 479 POKE P,0
 480 GOTO 497
 490 IF NOT F2 THEN LET E$(B)="X
"
```

```
 492 GOSUB 30
 493 LET U=U+1
 495 PAUSE 100
 496 POKE P,0
 497 NEXT A
 500 FOR A=1 TO 15
 505 GOSUB 10
 510 IF E$(B)="X" THEN GOTO 505
 512 PRINT AT 9,0;"TYPE IN THE "
;M$;" FOR--"
 515 PRINT AT 10,8;B$(B)
 520 INPUT D$
 525 GOSUB 25
 527 GOSUB 16
 530 IF LEN D$=L1 THEN GOTO 545
 535 LET D$=D$+" "
 540 GOTO 530
 545 IF D$=A$(B) THEN GOTO 560
 550 PRINT TAB 8;"NO, IT IS ";A$
(B);"."
 553 PAUSE 240
 554 POKE P,0
 555 GOTO 575
 560 GOSUB 30
 565 IF NOT F2 THEN LET E$(B)="X
"
 570 PAUSE 120
 571 POKE P,0
 572 LET U=U+1
 575 NEXT A
 580 CLS
 585 PRINT "YOU GOT ";U;", ";C$;
"."
 586 PRINT "A VERY GOOD SCORE IN
DEED."
 590 PRINT "HIT ENTER TO RETURN
TO MENU."
 592 INPUT D$
 595 GOTO 990
 600 PRINT "SPEED QUIZ---"
 605 GOSUB 20
 610 PRINT "I WILL GIVE YOU ";M$
;"S-TYPE IN THE ";N$;"S. AFTER 6
0 SEC. I WILL DISPLAY YOUR SCORE
.  I WILL GIVE YOU 1 POINT FOR A
 CORRECT ANSWER TAKE 1 POINT FOR
 AN INCORRECT ANSWER AND NOT DO
ANYTHING IF YOU ONLY PRESS ENTER
.  PRESS ENTER TO START."
 612 LET U=0
 615 INPUT D$
 620 POKE P-1,0
 625 POKE P,0
 630 GOSUB 10
 640 PRINT AT 10,8;A$(B)
 645 INPUT D$
 647 IF PEEK (P-1)+256*PEEK (P)<
61936 THEN GOTO 580
 650 IF D$="" THEN GOTO 630
 655 GOSUB 16
 657 IF LEN D$=L2 THEN GOTO 660
 658 LET D$=D$+" "
 659 GOTO 657
 660 IF D$<>B$(B) THEN LET U=U-1
 665 IF D$=B$(B) THEN LET U=U+1
 670 GOTO 630
 800 PRINT "YOUVE DONE VERY WELL
 ";C$;"."
 805 PAUSE 120
 806 POKE P,0
 807 PRINT
 810 PRINT "I HOPE YOU HAVE ENJO
YED YOURSELFAND LEARNED SOMETHIN
G."
 812 PRINT
 815 PAUSE 120
 816 POKE P,0
 820 PRINT "******* HAVE A NICE
DAY ********"
 822 PAUSE 1000
 823 POKE P,0
 824 CLS
 825 GOTO 100
 990 CLS
 995 GOTO 130
 996 SAVE L$
 997 GOTO 100
1000 PRINT "LIST LOADER PROGRAM"
1005 GOTO 1327
1008 LET F1=0
1009 PRINT "TYPE THE TITLE OF YO
UR LIST."
1010 INPUT T$
1011 LET P=16437
1012 LET F2=0
1013 LET Q=255
1015 CLS
1020 PRINT "TYPE THE TITLE(SINGU
LAR) OF THE 1ST CLASS OF ITEMS I
N YOUR LIST.  THE 1ST CLASS SHOU
LD CONSIST  OF THE LONGEST ITEMS
 IN LENGTH  IF POSSIBLE."
1030 INPUT M$
1035 CLS
1040 PRINT "HOW MANY CHARACTERS
ARE IN THE  LONGEST ITEM IN THE
1ST CLASS?"
1050 INPUT L1
1055 CLS
1060 PRINT "TYPE THE TITLE(SINGU
LAR) OF THE  2ND CLASS."
1070 INPUT N$
1075 PRINT "HOW MANY CHARACTERS
ARE IN THE  LONGEST ITEM IN THE
2ND CLASS?"
1080 INPUT L2
1085 CLS
1090 PRINT "HOW MANY ITEMS IN EA
CH CLASS OF THE LIST?"
1095 INPUT TOT
1100 CLS
1105 PRINT "TITLE-";T$
1110 PRINT "TITLE 1ST CLASS-";M$
1115 PRINT "LONGEST STRING 1ST C
LASS-";L1
1120 PRINT "TITLE 2ND CLASS-";N$
1125 PRINT "LONGEST STRING 2ND C
LASS-";L2
1130 PRINT "ITEMS IN LIST-";TOT
1135 PRINT
1140 PRINT "IS THIS INFORMATION
CORRECT-Y/N?"
1145 INPUT Z$
1150 IF Z$="N" THEN RUN 1000
1151 IF TOT<40 THEN LET F2=1
1160 DIM A$(TOT,L1)
1165 DIM B$(TOT,L2)
1170 DIM E$(TOT)
1175 CLS
1185 PRINT AT 10,0;"ENTER THE 1S
T ITEM IN THE 1ST   CLASS/THEN 1
ST ITEM IN 2ND CLASSTHEN 2ND ITE
M IN 1ST CLASS, ETC."
1190 FOR A=1 TO TOT
1200 IF NOT F1 THEN GOTO 1250
1205 SCROLL
1210 PRINT M$;"--";A$(A)
1215 SCROLL
1220 PRINT N$;"--";B$(A)
1225 INPUT Z$
1230 IF Z$="" THEN GOTO 1290
1250 SCROLL
1255 PRINT M$;"--";
1260 INPUT A$(A)
1265 PRINT A$(A)
1270 SCROLL
1275 PRINT N$;"--";
1280 INPUT B$(A)
1285 PRINT B$(A)
1290 NEXT A
1292 CLS
1295 IF F1 THEN GOTO 1320
1300 PRINT AT 10,0;" WE WILL NOW
 REVIEW EACH PAIR OFITEMS.  WHEN
 THEY COME ON THE   BOTTOM OF TH
E SCREEN, HIT ENTER IF THEY ARE
CORRECT.  HIT X AND THEN ENTER I
F THEY WRONG. THEN  ENTER EACH O
F THEM AS YOU DID   BEFORE."
1305 LET F1=1
1310 GOTO 1190
1320 PRINT "TYPE IN THE NAME YOU
 WISH TO     SAVE THIS PROGRAM UN
DER."
1325 INPUT L$
1326 PRINT "SAVE NAME--";L$
1327 PRINT
1328 PRINT
1330 PRINT
1335 PRINT "1. LOAD NEW LIST "
1336 PRINT "2. REVIEW/REVISE LIS
T "
1337 PRINT "3. CHANGE SAVE NAME"
1338 PRINT "4. SAVE PROGRAM"
1339 PRINT
1340 PRINT "TYPE IN THE NUMBER O
F YOUR        CHOICE.  IF YOU INTE
ND TO SAVE  START RECORDER AS SO
ON AS YOU   PRESS ENTER."
1345 INPUT A
1346 CLS
1347 IF A=4 THEN GOTO 996
1348 IF A=1 THEN RUN 1007
1349 IF A=3 THEN GOTO 1320
1350 IF A=2 THEN GOTO 1300
1355 GOTO 1330
```

Teaching with the ZX81

Eric Deeson

The Educational ZX80/1 Users' Group (EZUG) had a triple celebration in January. First, we were able to breathe a sigh of relief that we had survived a year of frenzied activity. Secondly, we welcomed the thousandth subscriber to our bimonthly newsletter. Thirdly, we launched our first educational ZX81 programs, fourteen of them in fact. Now, some months later our "membership" has passed 1500, and we have over forty validated and popular ZX81 programs on our list.

I make these points not because I want to plug the group, but to show that in Britain the year-old Sinclair micro is being taken seriously as a teaching resource. This will remain true, for a couple of years at least, despite the appearance of the remarkable Spectrum. While Spectrum and ZX81 programs are not interchangeable, they bear such a close relationship that rapid conversion is straightforward.

Our group's directory of suppliers to the ZX market currently lists organizations producing educational software for the machine. Also MUSE, Britain's leading educational computing organization, has given this record-breaking new machine a lot of support. Some support has come from Sinclair Research as well; in particular their educational software awards scheme attracted a great deal of interest.

Although actual data are very hard to come by, there is no doubt that already the ZX81 is by far the most popular micro in British schools. It compares very favorably with the longer-established front runners such as the Apple, the PET, and the Research Machines 380Z/480Z (a stolid, fairly old British microseries), and it is way ahead of the popular but newer BBC machine.

The number of ZX81s in use in British schools by now may exceed 10,000. This is as many as all other micros combined. Such success must be seen against the background of almost universal antagonism by the decision makers in our educational system. "The ZX81 is only a toy" is a common statement from inspectors and advisers; "Forget it," they say. A senior inspector with a large education authority even publicly stated the following: "If I come across a ZX81 in any of my schools, I'll stamp on it." British teachers tend to have a fairly low opinion of their advisers; such attitudes hardly help though I believe they are symptomatic of fear more than of anything else.

In a few areas, the authorities are now considering adopting the ZX81 as the official machine for the primary schools (Grades 1-6). But I know of none which provide much of the support that the teachers need such as courses, advice, software development, and so on.

Yet the ZX81 continues to infiltrate the schools at a breakneck pace, and the teachers are joining the Educational ZX80/1 Users' Group at a similar pace. The reasons for this are both external and internal. Schools and teachers are under pressure from pupils and parents to provide effective computing facilities and courses. That pressure is mainly linked to the ZX81 since it is by far the most popular micro in British homes.

Areas of Use

How are micros coming to be used in British education? The answer is not just applicable to the Sinclair range, of course, since to some extent at least the ZX81 can attempt anything other micros can do. And the answer is not just applicable to Britain because educational computing in North America is as progressive, successful, and exciting as on this side of the Ditch.

Furthermore, the answer is not just applicable to schools and colleges. The ZX81 is a help with the children's academic work at home, and many university departments have ZX81s around.

Classroom Uses

We can break the classroom uses down into the following categories.

Computer awareness. The primay aim is to increase familiarity with the computer and its uses. Most schools in Britain now attempt at least a few hours of this with all pupils.

Computer studies. The ZX81 is the apparatus used for formal computer instruction.

Computer-assisted learning. The computer joins the army of resources available for teaching in most subjects.

Other Uses in the School

Other school uses not directly in the classroom include:

Administration. The computer helps the daily routines of the school as it does in any other business.

Interfacing. Again the computer helps as in many other fields with data capture and process control.

Computer clubs. Many schools have thriving clubs in out-of-class time.

Fund raising. A major educational activity in Britain nowadays is the use of computer games for fund raising!

Developing software and hardware. Not a few schools find their facilities used by pupils (and teachers) for developing software and hardware products for sale.

Eric Deeson, Highgate School, Balsall Heath Road, Birmingham B12 9DS, U.K. Eric Deeson is the organizer of EZUG. For information about EZUG, send two international postal coupons (for air mail) to him at the above address.

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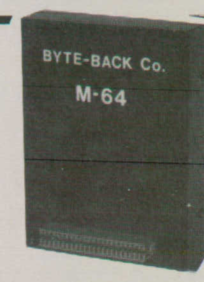

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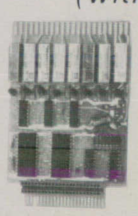

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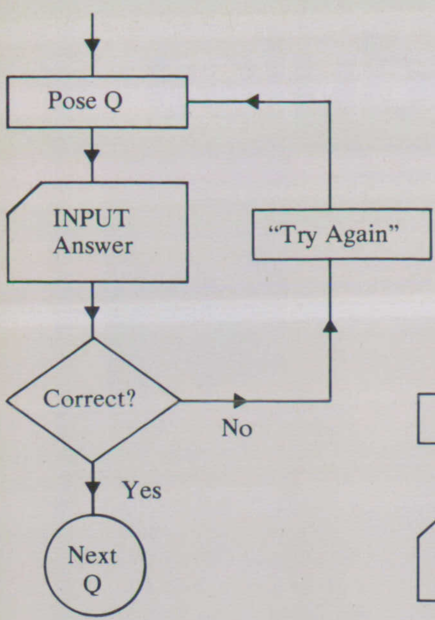
Figure 1. Flow Chart for Simple Q/A Routine.



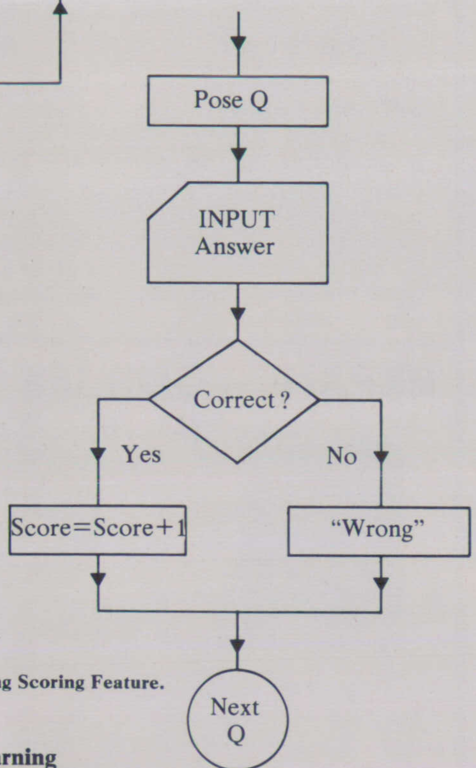


Figure 2. Flow Chart Adding Scoring Feature.

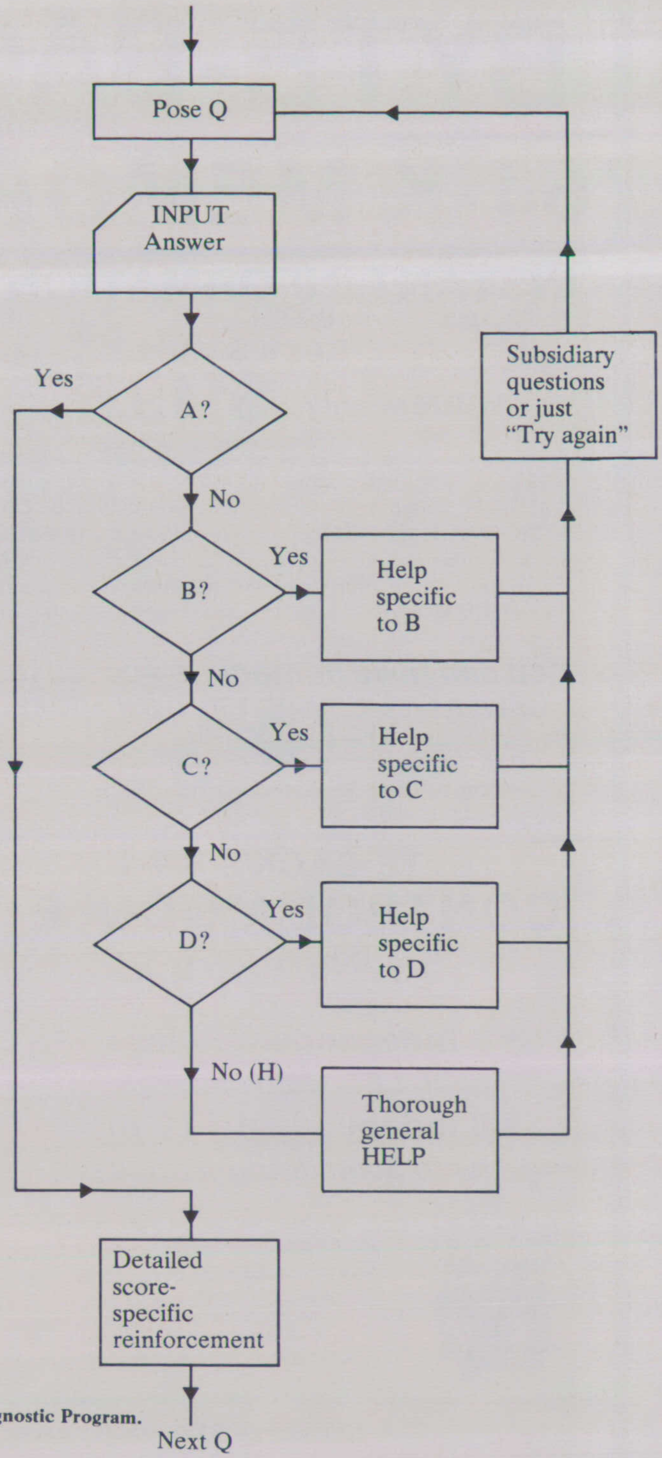


Figure 3. Flow Chart for Diagnostic Program.

Computer-Assisted Learning

Probably the main educational interest of most teachers and parents with a ZX81 is computer assisted learning (CAL).

McGraw-Hill's new *Devil's DP Dictionary* (which I hope you all get a chance to read!) has this to say:

CAI n. (Computer-Aided Instruction.) The misguided attempt to replace each teacher in the Bronx with 60 on-line terminals. CAL n. (Acronym for CALifornia or, archaic, Computer-Aided Learning.) A superior West Coast (USA) version of CAI in which each teacher is replaced by 25 on-line terminals.

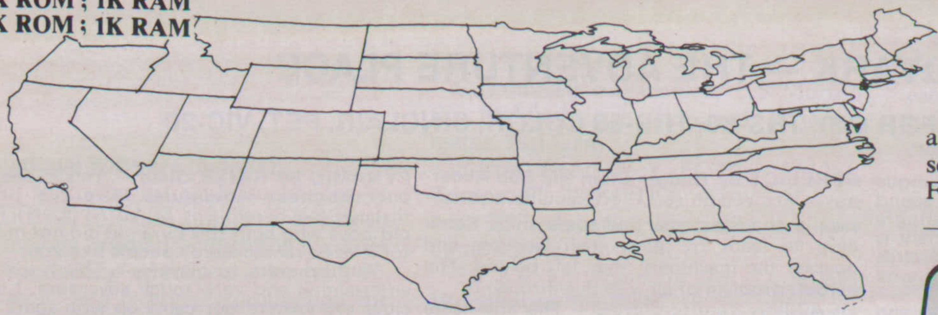
Some people think that in the not too distant future teachers will be replaced by computers. I do not agree, even though micros are far more effective than terminals. Indeed I shudder at the picture of a school in which the children spend all their time connected to a computer, living like chickens in a battery farm. (Impossible future? No! A recent book describes how a computer could check continuously that the user's eyes are following the screen display!)

At the moment, however, we have hardly taken a couple of steps along the road to such computer systems. The ZX81, like other established micros, can run only fairly simple teaching programs. It will be a long time before the PLATO approach reaches school level!

Such programs are, on the whole, simple mechanizations of the teaching machine material of a couple of decades ago. In most cases they are very crude, with each frame (unit of teaching) being on the lines of those shown in a flowchart such as shown in Figure 1. To program this kind of thing is obviously fairly straightforward (at least, as long as the question requires a very simple "objective" answer). It can be elaborated by adding a scoring feature as shown in Figure 2.

Teaching is not like that though. Programs must therefore progress towards mirroring classroom technique in sophistication, flexibility, and explanation. Thus correct responses require that the user be further checked for understanding; each incorrect response should lead to relevant remedial assistance. The flow chart in Figure 1 rapidly becomes unmanageable and must be replaced with the type in Figure 3.

8K ROM; 1K RAM
4K ROM; 1K RAM



Maps and the ZX80/81

Harry Doakes

Think about maps for a minute. We see them in one form or another almost every day, but we usually do not think about them even though there are some highly sophisticated theories about maps. We simply use them. We just want to figure how to get from here to there.

On a computer, however, a map is something we have to think about. Many computer games—and other applications, too—use maps to store and represent information. In this article, we will examine some ways of putting maps into your ZX80 or ZX81. We will also see how the Sinclair computers can generate complex maps by themselves.

Starting at the Beginning

What exactly is a map? Let us define it at this point as a representation of a group of places and of the ways of getting from one place to another.

One of the most familiar types is the road map. Cities and towns marked on the map with different types of dots; the roads are shown as lines of various sizes and colors. The towns are the places on the map, and the roads connect each of them to other towns.

One of the defining characteristics of a map is that every place on the map must be connected, somehow, with every other place on the map. Maybe the connection will not be direct. On a road map, for example, the route from town A to town B might lead through several other towns along the way. But, if you literally "can't get there from here," the two places are not really on the same map.

Actually, most road maps contain plenty of other information besides locations of towns and roads. For example, since a road map is usually a picture of an entire region, it also shows such features as rivers and lakes.

In addition to those extra details, all the distances on a road map are usually to scale. "To scale" means that distances on the road map are proportional to the distances in the real world. Thus one inch on the map might represent ten miles in the real world. That may seem pretty obvious, but not all maps are drawn to scale. Many do not need to be.

Concentration

A map drawn to scale contains a lot of information concentrated in a relatively small space. We scan the map quickly and get the information we need fast. That is, we process the information the map contains visually.

The very complete to-scale map is not nearly so useful to a computer though. To understand why, think about what you do to figure out how far it is from New York to Los Angeles.

1) You open up the map.
2) You find New York.
3) You find Los Angeles.
4) You measure the distance between the two cities.

Now think about what a computer has to go through to do the same thing:

1) It has to scan the entire map, one small section at a time, to look for New York.
2) It must repeat the whole process to find Los Angeles.
3) Having figured out where the two cities are, it has to measure the distance between them. Generally that is the easiest part of the task.

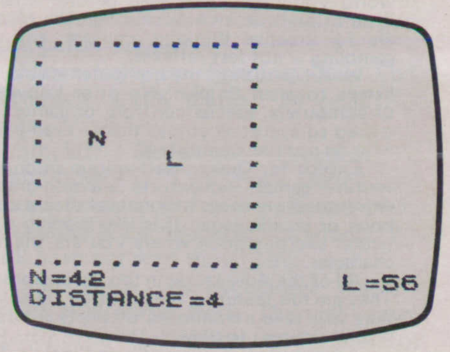
But before any of that happens, the computer must be able to scan the map. Since this generally means the map must be stored in the memory of the computer, lots of memory is required, much more than is reasonable for something as simple as figuring out how far it is between two cities.

The simple truth is this: human beings are good at processing visual information. Computers are not. As a result, the best kind of map for a human being may be the worst sort of map for a computer.

A Computer Map

The simplest kind of computer map is the equivalent of a map actually drawn on a piece of paper. For example, enter and run the program in Listing 1. Your screen display should look something like Figure 1.

Figure 1.



Listing 1.

8K ROM

```
 10 LET L=INT (RND*100)
 20 LET N=INT (RND*100)
 30 IF N=L THEN GOTO 20
 40 PRINT "............"
 50 FOR A=0 TO 9
 60 PRINT ".";
 70 FOR B=0 TO 9
 80 LET A$=" "
 90 IF 10*A+B=N THEN LET A$="N"
100 IF 10*A+B=L THEN LET A$="L"
110 PRINT A$;
120 NEXT B
130 PRINT "."
140 NEXT A
150 PRINT "............"
```

Changes for 4K ROM

```
 10 LET L=RND(100)-1
 20 LET N=RND(100)-1
```

This is a randomly generated map of New York and Los Angeles. The "N" represents New York, and the "L" Los Angeles.

It certainly looks like a map—a sort of map, anyway. And it is relatively easy for a human brain to understand. But it is not nearly so easy for a computer to work with. Remember that, using just the map, a computer calculating the distance between the two cities would have to scan every space on the map to find each of the cities. That is not too large a problem on a tiny map of 100 spaces. But for a map representing the entire United States, featuring a significant number of cities, it would take lots of time—and lots of memory.

A human brain has a huge capacity for processing and storing information, but a computer (especially a small, personal-size computer like the Sinclair) does not have the luxury of all that spare memory. For most computerized maps, drawing out the map for the computer to work with will not be very helpful.

A More Coordinated Version

The computer has several ways of handling this information instead of actually drawing out a map. One is to assign coordinates to each important place on the map. In Listing 1, for example, lines 10 and 20 assign a random position to

Harry Doakes, PO Box 10860, Chicago, IL 60610.

each of the two cities. Finding the distance between the two cities would be much easier for the computer if it could

Listing 2.

8K ROM

```
160 LET A=INT (N/10)-INT (L/10)
170 LET B=N-L-10*A
180 LET A=INT SQR (A*A+B*B)
190 PRINT "N=";N,"L=";L
200 PRINT "DISTANCE=";A
```

Changes for 4K ROM

```
 10 LET L=RND(100)-1
 20 LET N=RND(100)-1
160 LET A=N/10-L/10
180 LET C=A*A+B*B
190 IF A<0 THEN LET A=-A
200 IF NOT C>A*A THEN GO TO 230
210 LET A=A+1
220 GO TO 200
230 PRINT "N=";N,"L=";L
240 PRINT "DISTANCE=";A
```

deal directly with the variables N and L.

The program in Listing 2 lets it do exactly that. This time, there is no visual map for the human being, but the computer can give us the information we want much faster because it is working with a map is designed for it.

To get a human-readable version of the map at the same time, combine the two programs into one—none of the line numbers will conflict—and run the resulting program. In one sense, what we have done in the second program is to eliminate all the "white space" from the first map. Only the pertinent information is left.

The Real World

In most computer games, it is assumed that the whole universe is divided up into squares, and that you always move from one square to the next. This a system lends itself well to simple maps.

If you are pretending to fight monsters or shoot aliens, it may work fine, but the real world is not so convenient. Consider an airline route map, for example. You can create a computer map that shows all the territory between cities, but there is not much point in that since airplanes always fly directly from one place to another. All that "white space" just gets in the way. Remember what a map is: simply a group of interconnected places.

Suppose you want to make an airline map containing New York and Los Angeles. You might do it like this:

Places:	Routes:
New York (NY)	NY-LA: 2800 miles
Los Angeles (LA)	

You might also include another route—LA-NY: 2800 miles. In this case it is safe to assume that the route goes in both directions, but that is not always true. If you were making a map of a plumbing system or a circuit board, it might be important to know which way everything was moving. For now, though, assume that there are no one-way routes.

Bigger and Better

Of course, there is no reason to limit this map to two cities. Let's expand it as in Figure 2. This looks like a long list of interconnections, but actually it is rather straightforward. In a computer, the important information—the distances—could be represented in a single one-dimensional array which requires far less memory than an accurately scaled visual map.

Figure 2.

Places:	Route:	Miles
(1) New York	(1) NY-LA	2800
(2) Los Angeles	(2) NY-Ch	840
(3) Chicago	(3) NY-Ho	1650
(4) Houston	(4) NY-Bo	220
(5) Boston	(5) NY-SF	3040
(6) San Francisco	(6) LA-Ch	2100
	(7) LA-Ho	1550
	(8) LA-Bo	3050
	(9) LA-SF	410
	(10) Ch-Ho	1100
	(11) Ch-Bo	1000
	(12) Ch-SF	2410
	(13) Ho-Bo	1860
	(14) Ho-SF	1950
	(15) Bo-SF	3170

The Traveling Salesman

Now suppose you are a salesman who has to visit six cities, beginning in one of them and ending in the same city you started from. How can you find the route that requires the least amount of traveling, that is, the route that covers the shortest distance? (This is a variation of the old "traveling salesman" problem.)

We find that there are six-factorial possible routes. (Six-factorial, or 6, means 6x5x4x3x2x1, or 720.) Some of these are virtually identical, following the same route but starting in a different city, or running the route backwards. But even after eliminating duplication, there are still 60 different possibilities to choose from. Which one is shortest?

You could figure out all the possible routes, if you had lots of paper and lots more time. However, with this map of the six cities, it is easy for the computer to figure out every route and then tell you which circuit is the most efficient.

Listing 3 is a program to try all the different routes. The 8K version requires over 1K RAM. To use the program on the 4K ROM, make the changes at the end of the listing.

The first lines of the program load the distances into the D array. Then P (the current "shortest distance" for the whole circuit) is set very high, and the A array is set up as 1, 2, 3, 4, 5, 6 to indicate a route through New York, Los Angeles, Chicago,

Listing 3.

8K ROM

```
   1 REM 2800,0840,1650,0220,304
0,2100,1550,3050,0410,1100,1000,
2410,1860,1950,3170
  10 DIM A(7)
  20 DIM D(15)
  30 FOR D=1 TO 15
  40 FOR A=16509 TO 16512
  50 LET D(D)=10*D(D)+PEEK (5*D+
A)-28
  60 NEXT A
  70 NEXT D
  80 LET P=32767
  90 FOR A=1 TO 6
 100 LET A(A)=A
 110 NEXT A
 120 GOSUB 1000
 130 FOR D=1 TO 4
 140 LET N=6-D
 150 FOR A=N TO 5
 160 IF A(A+1)>A(A) THEN GOTO 20
0
 170 NEXT A
 180 NEXT D
 190 STOP
 200 LET A(N)=A(N)+1
 210 FOR A=1 TO N-1
 220 IF A(A)=A(N) THEN GOTO 200
 230 NEXT A
 240 LET N=N+1
 250 IF N=7 THEN GOTO 120
 260 LET A(N)=1
 270 GOTO 210
1000 LET R=0
1005 LET A(7)=A(1)
1010 FOR D=1 TO 6
1020 LET Q=0
1030 FOR A=1 TO 5
1040 FOR B=A+1 TO 6
1050 LET Q=Q+1
1060 IF A(D)=A AND A(D+1)=B OR A
(D)=B AND A(D+1)=A THEN GOTO 110
0
1070 NEXT B
1080 NEXT A
1090 RETURN
1100 LET R=R+D(Q)
1110 NEXT D
1120 IF R>P THEN RETURN
1130 IF R<P THEN CLS
1140 LET P=R
1150 FOR A=1 TO 7
1160 PRINT A(A);
1170 NEXT A
1180 PRINT TAB 8;P
1190 RETURN
```

Changes for 4K ROM

```
  40 FOR A=16422 TO 16425
  50 LET D(D)=10*D(D)+PEEK(5*D+A
)-28
1180 PRINT ,P
```

Houston, Boston, San Francisco, and then back to New York. The rest of the main program simply generates a new route each time, while the subroutine beginning at line 1000 calculates how long each route is.

It should only take about three minutes for a ZX80 to come up with the shortest route.

Trees

It should be clear by now that different kinds of maps are useful for different purposes. For a human being to find the right highway, a road map works just fine. For a computer to solve the "traveling salesman" problem, we saw a better kind of map.

A third type that has a very specialized use is the "tree-structured" map. Remember what the defining characteristic of any map is: it represents a group of interconnected things. A tree-structured

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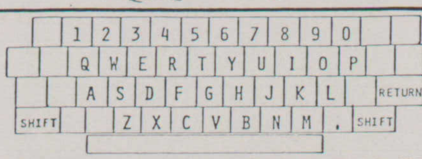

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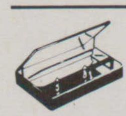
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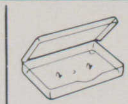
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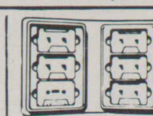
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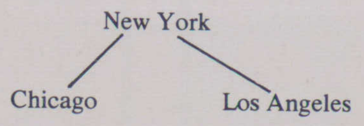
Computer make & model ______________________ map has one additional characteristic: the map begins with a single place (or thing), and exactly one new connection is made for each new place (or thing) on the map.

The best way to understand this type is with an example. Let's start out with a map like this:

New York

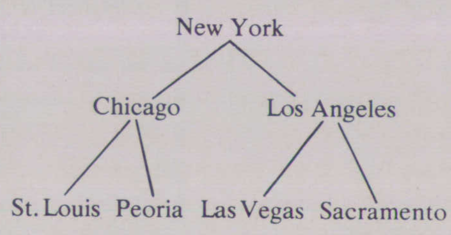
True this is not much of a map, but now add some more cities:



Notice that the new cities are connected to New York, but not to each other. Why not? Think about the definition of a tree-structured map. It starts out with one place—New York. Then, with each city added to the map, exactly one new connection is made. Thus there will always be more cities than connections—exactly one more, in fact.

Let's make the map still larger as in Figure 3. Once again, there is just one new connection for each new city. One way of looking at this is to say that each new city connects to exactly one previously existing city.

Figure 3.

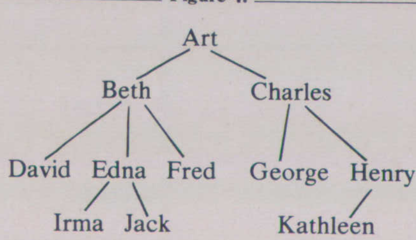


Shaking the Family Tree

How useful can a map like this be? Not very, if you are looking for a road map. Most cities are a little better connected than that.

But consider for a moment a family tree. It works exactly like a tree-structured map. For example, Figure 4 shows a visual map of a family tree covering four generations. If we consider this tree structure as a map with places and routes (the places are people, and the routes are lines of parentage), it will look like this:

Figure 4.



Places:	Routes:
Art	
Beth	Art to Beth
	Art to Charles
David	Beth to David
Edna	Beth to Edna
Fred	Beth to Fred
George	Charles to George
Henry	Charles to Henry
Irma	Edna to Irma
Jack	Edna to Jack
Kathleen	Henry to Kathleen

As you would expect in a family tree, each new person is the son or daughter of exactly one person already in the tree. That means there will be just one new connection for each new person; the number of connections is one less than the number of family members.

Counting Off

Now suppose we give everyone in our family tree a number, beginning with zero, and each family connection a number, beginning with one. Since there is one more family member than connections, we find that the member and the connection have the same number. The result looks like this:

Places:	Routes:
(0) Art	
(1) Beth	(1) (0,1)
(2) Charles	(2) (0,2)
(3) David	(3) (1,3)
(4) Edna	(4) (1,4)
(5) Fred	(5) (1,5)
(6) George	(6) (2,6)
(7) Henry	(7) (2,7)
(8) Irma	(8) (4,8)
(9) Jack	(9) (4,9)
(10) Kathleen	(10) (7,10)

Now something else becomes obvious: the second element of each pair matches the route number. Why? Because a tree structure gets bigger by one place and one route at a time. Each new place connects, by a new route, to some previous place. Each new family member is the son or daughter of exactly one previous family member.

This map is significantly different from the one we made of the six cities. For that map, we got all the distances into one array, but to do it we used the programming trick found in lines 1030-1080. The trick was necessary to fit the program into 1K, but it is still a trick.

With a tree structure, there is no gimmick involved. We really can represent the entire map in a single one-dimensional array which is a very memory-efficient way of making a very complex and extensive map of a tree.

A-Maze-Ment

If a carefully constructed map of the tree type be stored as an array, why not stand the process on its head? We should be able to use an array full of random numbers as a maze.

We must keep a few things in mind. First, the random numbers have to be chosen within the right range. Remember, every place on a map has to connect, directly or indirectly, with every other place. Second, to keep the maze from being too easy we should scramble some of the connections and add some extra cross-connections to the basic tree structure.

A program that does all of these things and puts them together to generate a complex random maze of almost any size is given in Listing 4. The 8K ROM version requires over 1K RAM. To use on the 4K ROM, make the changes at the end of the listing.

Listing 4.

8K ROM

```
10 PRINT "NUMBER OF ROOMS?"
20 INPUT N
30 DIM D(2*N)
40 FOR A=1 TO N
50 IF A=1 THEN LET D(A)=0
60 IF A>1 THEN LET D(A)=INT (R
ND*(A-1))+1
70 NEXT A
80 FOR A=N+1 TO 2*N
90 LET D(A)=INT (RND*N)+1
100 IF D(A)=A-N THEN GOTO 90
110 IF RND>.5 THEN GOTO 150
120 LET L=D(A)
130 LET D(A)=D(A-N)
140 LET D(A-N)=L
150 NEXT A
160 LET Q=INT (RND*N)+1
170 CLS
180 PRINT "YOU ARE ";
190 IF Q>0 THEN GOTO 220
200 PRINT "OUTSIDE--YOU MADE IT
"
210 STOP
220 PRINT "IN ROOM ";Q;" WITH "

230 GOSUB 400
240 PRINT 2*N-L;" DOORS.  WHICH
DOOR?"
250 INPUT L
260 GOSUB 410
270 IF L<>0 THEN GOTO 250
280 IF Q=D(A) THEN GOTO 310
290 LET Q=D(A)
300 GOTO 170
310 LET Q=A+N*(A>N)
320 GOTO 170
400 LET L=2*N
410 FOR A=1 TO 2*N
420 IF A=Q OR A=Q+N OR D(A)=Q T
HEN LET L=L-1
430 IF L<>0 THEN NEXT A
440 RETURN
```

Changes for 4K ROM

```
60 IF A>1 THEN LET D(A)=RND(A-
1)
90 LET D(A)=RND(N)
110 IF RND(2)=1 THEN GO TO 150
160 LET Q=RND(N)
270 IF L THEN GO TO 250
430 IF L THEN NEXT A
```

The program is rather straightforward. The first FOR/NEXT loop generates a random tree structure. The second loop adds interconnections between the rooms of the maze and mixes up the doorways so it will not be as easy to find the way out. Line 160 starts the player in a random room. The subroutine beginning at line 400 or 410 is used both to count the number of doors in each room (GO SUB 400), and to find where each door leads (GO SUB 410).

It may surprise you that a maze with close to 100 rooms will fit into 1K RAM. Enter the program and try it. You will discover that finding your way through the maze is quite tricky. That is because the maze is genuinely complex: the rooms are not laid out on any kind of flat surface, but are completely random.

This type of mapped maze can be adapted for use with any game that involves a multitude of rooms or locations—caves, castles, dungeons, or haunted houses. However, it will probably require more than 1K RAM. On the other hand, this "different every time" is an interesting and challenging game in itself.

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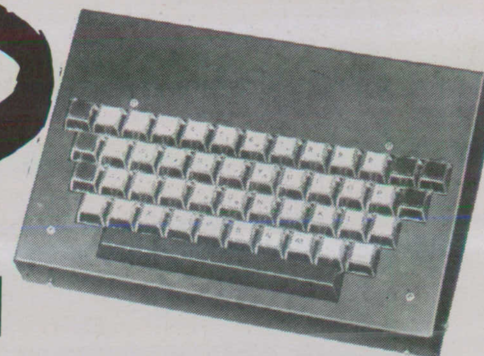

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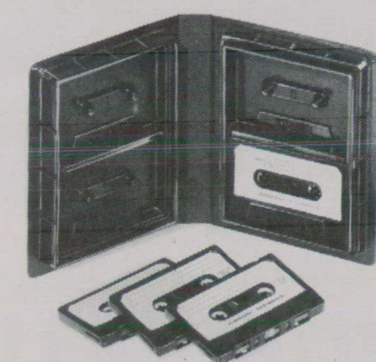

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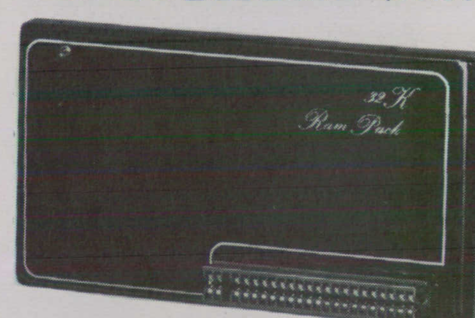

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8K ROM; 2K RAM
4K ROM; 1K RAM

How Many Blocks?

Patrick Kelly

The Problem

Like most new computer owners, I was testing my new equipment with some games. My fun was interrupted, though, when I realized that I was being watched. As I turned, I was confronted by my five year-old daughter, Scooter. Wearing a sad face and eyes that reminded me of a beagle puppy, she muttered, "How 'bout me?" Needless to say, I was at a loss for words because there do not seem to be many programs available for her age bracket. The obvious solution was to write a program just for her.

Program Requirements

The first step was to outline the requirements for the program:

1) The knowledge or skill involved should be within the child's present ability to avoid excessive failure.

2) The program should be fun and game-like to hold the child's attention.

3) The program should also be educational so that the child will learn from it.

4) The means of positive/negative feedback should be within the child's present ability to comprehend.

5) The program will need minimal cues for an adult to give assistance to get the child started.

Patrick Kelly, PO Box 7162, Los Angeles, CA 90022.

Methods of Meeting the Requirements

The next step was to decide how to fulfill these requirements. Printed words were out of the question since Scooter had not learned to read or write yet. She was vaguely familiar with single printed digits and was learning to count. Pictures using the computer's graphics capabilities could also serve as a means of communication.

The Program Concept and Aim

The third step was to get the basic program concept and aim. I decided on a program to develop her abilities to count and associate the counting process with the single numerals. For positive feedback I chose the "happy face," and for the negative feedback, the "sad face." See Listing 1 for the 4K ROM program and Listing 2 for the 8K ROM.

Using the Program

Only 10 keys are involved in the child's interaction with the computer (1 to 9 and NEWLINE). I had considered making a keyboard overlay with a piece of paper marked for the ten active keys, but that would have been an open invitation to lean on the unmarked surface with the possibility of miskeying the computer. Instead I just marked the case of the computer with a small arrow pointing to the NEWLINE key and emphasized that she must touch only one key at a time. After all, learning to use the keyboard is a part of the learning exercise, too.

After entering the program, hit RUN and NEWLINE. The words "HOW MANY BLOCKS?" will appear on the first line, and a row of from one to nine blocks will be displayed on the next line. The child should count the blocks and press the key for that number and NEWLINE. If the answer is correct, the "happy face" will appear on the screen. If the answer is wrong, a "sad face" will appear. To continue, hit NEWLINE. To stop, hit any key and NEWLINE.

I hope that the pre-schoolers will enjoy this program and learn something at the same time. It is not offered as a ready-made solution for every reader. Rather it is hoped that other Sinclair users will be inspired to develop programs for a hitherto neglected user group.

Program Notes

Lines 10-70 set up the faces.

Line 100 picks the random number for the block display. On the 4K the RANDOMIZE statement is not necessary for a program on this simple level.

Lines 110 and 510 are the guides for the adult. The child will disregard them in short order.

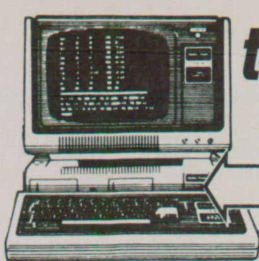
Lines 120-140 control the block display.

Line 200 inputs the child's answer.

Line 210 clears the screen to prevent display overflow.

Line 220 makes sure that only a single digit is entered as the answer. A zero or multiple digits will cause the computer to re-display the previous number of blocks and request the answer again.

Line 230 decides whether the answer is right or wrong, that is, which face to display as feedback.



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Line 300 displays a "sad face." Note that on the 4K ROM version the three commas between each string make the computer skip three fields between the displaying of each graphic line so that they will line up correctly in the corner of the screen. On the 8K ROM only 2 commas are needed. This method was chosen instead of multiple print statements.

Line 310 bypasses displaying an unwanted "happy face" after the "sad face."

Line 400 displays a "happy face." All the comments on Line 300 apply here.

Line 500 spaces one line downward.

Line 600 inputs the command to continue or to stop. NEWLINE alone will cause the computer to continue.

Line 610 clears the screen for the next group of blocks and prevents display overflow.

Lines 620-640 have several functions. First, they decide whether to continue or to stop. If instructed to continue, they then decide whether the child's previous answer is right or wrong. If the answer is right, a new set of blocks will be displayed. If the answer is wrong, the previous set will be displayed again. This will continue until the correct answer is given.

Listing 1. How Many Blocks (4K ROM).

```
 10 LET A$="AAAAAAAAA"
 20 LET B$="A#######A"
 30 LET C$="A#WW#WW#A"
 40 LET D$="A##RWE##A"
 50 LET E$="A#W###W#A"
 60 LET F$="A##W#W##A"
 70 LET G$="A###W###A"
100 LET A=RND(9)
110 PRINT "HOW MANY BLOCKS?"
120 FOR I=1 TO A
130 PRINT "Q#";
140 NEXT I
150 PRINT
200 INPUT B
210 CLS
220 IF B<1 OR B>9 THEN GOTO 11
0
230 IF B=A THEN GOTO 400
300 PRINT A$,,,B$,,,C$,,,B$,,,D
$,,,B$,,,G$,,,F$,,,E$,,,B$,,,A$
310 GOTO 500
400 PRINT A$,,,B$,,,C$,,,B$,,,D
$,,,B$,,,E$,,,F$,,,G$,,,B$,,,A$
500 PRINT
510 PRINT "HIT N/L TO CONTINUE"
600 INPUT H$
610 CLS
620 IF H$="" AND NOT B=A THEN G
OTO 110
630 IF H$="" THEN GOTO 100
640 STOP
```

Listing 2. How Many Blocks (8K ROM; over 1K RAM).

```
 10 LET A$="AAAAAAAAA"
 20 LET B$="A#######A"
 30 LET C$="A#DD#DD#A"
 40 LET D$="A##261##A"
 50 LET E$="A#D###D#A"
 60 LET F$="A##D#D##A"
 70 LET G$="A###D###A"
100 LET A=INT (RND*9)+1
110 PRINT "HOW MANY BLOCKS?"
115 PRINT
120 FOR I=1 TO A
130 PRINT "5#";
140 NEXT I
200 INPUT B
210 CLS
220 IF B<1 OR B>9 THEN GOTO 1
10
230 IF B=A THEN GOTO 400
300 PRINT A$,,B$,,C$,,B$,,D$,,B
$,,G$,,F$,,E$,,B$,,A$
310 GOTO 500
400 PRINT A$,,B$,,C$,,B$,,D$,,B
$,,E$,,F$,,G$,,B$,,A$
500 PRINT
510 PRINT "HIT N/L TO CONTINUE"
600 INPUT H$
610 CLS
620 IF H$="" AND B<>A THEN GOTO
110
630 IF H$="" THEN GOTO 100
640 STOP
```

8K ROM; 2K RAM
4K ROM; 1K RAM

Elimination

A. Dan Klyver

Elimination is a traditional dice game which provides a worthwhile vehicle for teaching young children (and others) simple strategy, an understanding of odds, and the mental manipulation of numbers. Consequently, it helps reinforce arithmetic skills since the player's ability to use mental arithmetic is pitted against the computer's problem posing ability. Although the game is fun to play alone, a group can play by each taking a turn and keeping score to see who can do the best job of eliminating numbers.

Enter the program in Listing 1 and hit NEWLINE. The numbers 1 to 9 will appear together with the randomly produced results of a dice roll. You are prompted to make a choice(s) of which number or numbers you wish to eliminate in the range of 1 to 9. See Figure 1. The total of the numbers selected for elimination must equal the total of the dice role. For example, if on the first roll of the game, you roll a 5 and a 4, you may eliminate a 9 or any combination of numbers totaling 9.

The object of the game is to eliminate all of the numbers. The selection of a given number or combination of numbers is up to the player, but the odds of rolling any particular number should be considered when making the selection.

After making the selection, hit NEWLINE. The selected numbers will become zero(s). This will indicate that they have been eliminated and cannot be played again. The results of a new dice roll will also be displayed. The game proceeds with the next selection.

Improper entries will result in early termination of the game (a penalty for making a mistake). When the game is approaching the end, a roll that is not compatible with the remaining numbers will terminate the game with the total of the remaining numbers being displayed as the score. The lowest number wins.

To play again, hit NEWLINE. To revert to the program listing, enter four letters and hit NEWLINE. After a "win" is scored (all numbers eliminated), the program will be listed again.

A. Dan Klyver, 29 Old Stagecoach Rd., Weston, CT 06883.

4K ROM Version

The program listing is for the 8K ROM, but it can be adapted to the 4K ROM by making the following changes:

```
110 RANDOMISE
120 LET X=RND(6)
140 LET Y=RND(6)
180 PRINT "ENTER YOUR CHOICE(S)
 ONE AT A    TIME EACH FOLLOWED B
Y ENTER"
200 IF NOT B(Q)=Q THEN GOTO 270
220 IF NOT B(R)=R THEN GOTO 270
240 IF NOT S=B(S) THEN GOTO 270
260 IF NOT T=B(T) THEN GOTO 270
330 PRINT "GAME OVER, TO REPLAY
HIT ENTER"
450 IF NOT B(A)=0 THEN GOTO 50
```

Listing 1. Elimination (8K ROM).

```
 10 DIM B(9)
 20 FOR A=1 TO 9
 30 LET B(A)=A
 40 NEXT A
 50 PRINT "THE NUMBERS TO BE EL
IMINATED ARE"
 60 PRINT
 70 FOR A=1 TO 9
 80 PRINT B(A);" ";
 90 NEXT A
100 PRINT
110 RAND
120 LET X=INT (RND*6)+1
130 PRINT
140 LET Y=INT (RND*6)+1
150 LET Z=X+Y
160 PRINT "YOU ROLLED A ";X;" A
ND A  ";Y
170 PRINT
180 PRINT "ENTER YOUR CHOICE(S)
 ONE AT A    TIME EACH FOLLOWED B
Y N/L"
190 INPUT Q
200 IF B(Q)<>Q THEN GOTO 270
205 IF Q=Z THEN GOTO 420
210 INPUT R
220 IF B(R)<>R THEN GOTO 270
225 IF R+Q=Z THEN GOTO 410
230 INPUT S
240 IF S<>B(S) THEN GOTO 270
245 IF Q+R+S=Z THEN GOTO 400
250 INPUT T
260 IF T<>B(T) THEN GOTO 270
265 IF Q+R+S+T=Z THEN GOTO 390
270 PRINT
280 LET V=0
290 PRINT
300 FOR P=1 TO 9
310 LET V=V+B(P)
320 NEXT P
330 PRINT "GAME OVER, TO REPLAY
HIT N/L"
340 PRINT
350 PRINT "SCORE=";V
360 INPUT G$
370 CLS
380 GOTO 10
390 LET B(T)=0
400 LET B(S)=0
410 LET B(R)=0
420 LET B(Q)=0
430 CLS
440 FOR A=1 TO 9
450 IF B(A)<>0 THEN GOTO 50
460 NEXT A
470 PRINT "YOU WIN"
```

Figure 1. Sample Run.

```
THE NUMBERS TO BE ELIMINATED ARE

0 0 0 0 0 0 0 8 0

YOU ROLLED A 1 AND A  1

ENTER YOUR CHOICE(S) ONE AT A
TIME EACH FOLLOWED BY N/L


GAME OVER, TO REPLAY HIT N/L

SCORE=8
```

Arithmetic with a Smile

George J. Repicky

The computer as an instructional tool is perhaps nowhere more successful than in conducting arithmetic practice drills. Unlike the typical classroom teacher, the computer never tires and never makes a mistake. It provides arithmetic practice and never forgets to reward a right answer with a smile.

Addition

Enter the program in Listing 1 and then RUN it. This is the basic program. It will generate an addition problem and print it in the upper left hand corner of the screen. The computer then awaits the user's answer. If the answer is correct, the complete problem with the correct answer is displayed, and the user is rewarded with a smile. After a five second pause a new problem is displayed. If the answer is wrong, the problem is again displayed along with the incorrect answer. The user is again asked the question while a frown is displayed. Entering a letter instead of a number will stop the program.

Listing 1. Addition Practice.

```
110 RAND
120 CLS
130 LET X=INT (RND*10)
140 LET Y=INT (RND*10)
150 PRINT
160 PRINT X;" + ";Y;" = ?"
170 INPUT Z
180 CLS
190 PRINT
200 PRINT X;" + ";Y;" = ";Z
210 FOR N=1 TO 20
220 PLOT 10*SIN (N*PI/10)+31,10
*COS (N*PI/10)+22
230 NEXT N
240 PLOT 26,26
250 PLOT 36,26
260 PLOT 31,22
270 PLOT 31,17
280 PLOT 30,17
290 PLOT 32,17
300 IF Z<>X+Y THEN GOTO 350
310 PLOT 29,18
320 PLOT 33,18
330 PAUSE 250
340 GOTO 120
350 PLOT 29,16
360 PLOT 33,16
370 PRINT
380 GOTO 160
```

George J. Repicky, 49 Roosevelt Ave., Schenectady, NY 12304.

Other Arithmetic Operations

The other arithmetic operations can be done with the following modifications to the program in Listing 1:

Subtraction

140 LET Y=INT(RND*X)
160, 200, 300: Change + to -.

Multiplication

160, 200, 300: Change + to *.

Division

130 LET Y=INT(RND*9)+1
140 LET X=INT(RND*10)*Y
160, 200, 300: Change + to /.

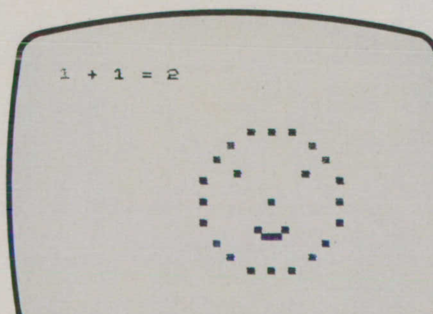
For those who do not need a smile or frown to make the drill more lively, the lines generating the face can be omitted.

Notes

Addition

110: Sets the seed of the random number generator.

130: Sets the range of numbers the random number generator can choose from for one number of the drill problem. To increase the range, increase the number in parentheses. This will give more difficult problems, but a bit more memory may be necessary. If so, delete Lines 150 and 190.



140: Does the same for the other number of the problem.

160: Presents the problem.

170: Inputs the user's answer.

200: Presents problem with user's answer.

210-230: Draw face outline.

240-260: Draw eyes and nose.

270-290: Draw part of mouth.

300: Branches to reprint problem and frown for wrong answer.

310-320: Complete the smile.

330: Generates 5 second pause.

340: Goes back to present next problem.

350-360: Complete the frown.

380: Returns to input the user's next answer.

Subtraction

140: Provides a problem with a non-negative number.

Division

130, 140: Assure that the dividend is evenly divisible.

Listing 2. Addition Practice (4K ROM)

```
110 RANDOMISE
120 CLS
130 LET X=RND(10)-1
140 LET Y=RND(10)-1
150 PRINT
160 PRINT X;"#+#";Y;"#=#?"
170 INPUT Z
180 CLS
190 PRINT
200 PRINT X;"#+#";Y;"#=#";Z
210 PRINT
220 PRINT
230 PRINT ,"###F#DF"
240 PRINT ,"##E######E"
250 PRINT ,"#E########E"
260 PRINT ,"D#R####R##D"
270 PRINT
280 PRINT ,"E####E####E"
290 PRINT ,"D","##D"
300 PRINT ,"####";
310 IF NOT Z=X+Y THEN GO TO 340
320 PRINT CHR$(136);"WE"
330 GO TO 370
340 PRINT "FW"
350 PRINT ,"#E##E#E##E"
360 REM
370 PRINT ,"#E","#E"
380 PRINT ,"##EF#DF#E"
390 PRINT
400 IF NOT Z=X+Y THEN GO TO 160
410 INPUT I$
420 RUN
```

%

Subtraction

```
140 LET Y=RND(X+1)-1
160, 200, 310, 400:
  Change the + to -
```

Multiplication

```
160, 200, 310, 400:
  Change the + to *
```

Division

```
130 LET Y=RND(9)
140 LET X=(RND(10)-1)*Y
160, 200, 310, 400:
  Change the + to /
```

8K ROM; 2K RAM
4K ROM; 1K RAM

Arithmetic Series Quiz

Richard Van Workum

One exercise to sharpen arithmetic skills is to use a series of numbers which require discerning the relationships of the numbers in order to complete the series. The program in Listing 1 will print out an arithmetic series. Your task is to figure out the next two numbers in the series. If you are not successful in two tries, the answer is given.

Line 1 stores the data to construct each series. Memory is saved by using the alphabet for storing two digit numbers in the same way that the hexadecimal system uses A to F for representing 10 to 16 in the decimal system. Data is stored in blocks starting with Z which is used as a flag to tell the computer where each block begins.

Line 30 randomizes which block of data is to be used. The computer then searches for the beginning of the block in line 35. A constant is added to the series to make the program more challenging. The end of each block is flagged by the Z of the next block or by 118 (NEWLINE) which is the end of the REM statement. The series is printed on the screen except for the last two numbers which the player has to figure out.

The program is packed tightly in 1K RAM on the ZX80 and requires over 1K RAM on the ZX81. Memory is saved by using keyboard commands in lines 170, 600, and 610. In this way the program provides the maximum variety of series in the small memory.

To exit the program, key in a unused variable letter when asked for a number, or key in a character when "N/L FOR NEW SERIES" is printed.

Enter the program in Listing 1. If you have the 4K ROM make the changes in Listing 2 as you enter the program. Hit RUN and ENTER, and stretch your arithmetic perceptions.

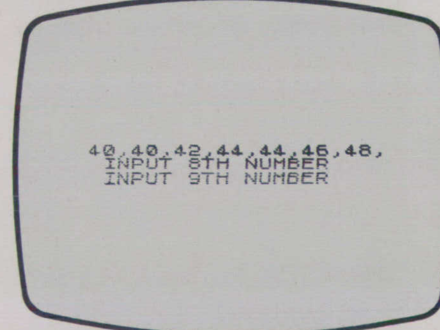
Richard Van Workum, 920 Leslie Ln., Hanford, CA 93230. Program translated to 8K ROM by James Grosjean.

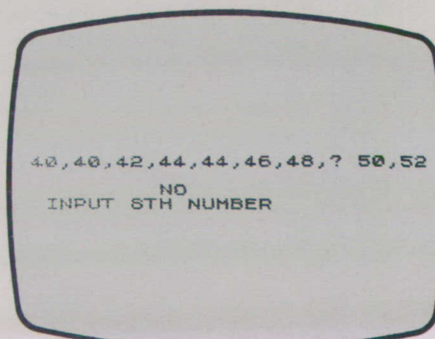
Listing 1. Arithmetic Series Quiz Program (8K ROM).

```
   1 REM Z019238457Z607162534Z04
815926AZ30748BFCJZ405366798Z0341
56278Z420642664Z02B35B68BZ042646
6A8Z0257ACFHKZ1L3N5P7R9ZA9865421
0Z0235689BCEZCB9865320Z00244688A
Z051627384Z320542764Z02441355246
6ZAGF8ED5CB1A9
  14 DIM V(12)
  15 DIM G(2)
  20 LET R=INT (RND*100)+1
  22 LET K=0
  25 LET L=0
  30 LET M=16513+INT (RND*197)+1
  35 IF PEEK M=63 THEN GOTO 50
  40 LET M=M-1
  45 GOTO 35
  50 LET M=M+1
  55 IF PEEK M=63 OR PEEK M=118
THEN GOTO 95
  70 LET L=L+1
  75 LET V(L)=PEEK M-28+R
  80 GOTO 50
  95 GOSUB 500
 110 PRINT
 115 GOSUB 600
 120 IF G(1)=V(L-1) AND G(2)=V(L
) THEN GOTO 150
 125 GOSUB 500
 130 PRINT "? ";G(1);",";G(2)
 132 PRINT
 133 PRINT TAB 8;"NO"
 134 IF K=1 THEN PRINT V(L-1);",
";V(L)
 135 IF K=1 THEN GOTO 170
 136 LET K=1
 140 GOSUB 600
 145 GOTO 120
 150 GOSUB 500
 155 PRINT G(1);",";G(2)
 160 PRINT
 165 PRINT TAB 8;"YES"
 170 PRINT "N/L FOR NEW SERIES"
 175 INPUT A$
 180 IF A$="" THEN GOTO 20
 185 STOP
 500 CLS
 505 FOR I=1 TO L-2
 510 PRINT V(I);",";
 515 NEXT I
 520 RETURN
 600 PRINT "  INPUT ";L-1;"TH NU
MBER"
 605 INPUT G(1)
 610 PRINT " INPUT ";L;"TH NUMBE
R"
 615 INPUT G(2)
 620 RETURN
```

Listing 2. Changes for 4K ROM.

```
  20 LET R=RND(100)
  30 LET M=16426+RND(197)
  35 IF PEEK(M)=63 THEN GOTO 50
  55 IF PEEK(M)=63 OR PEEK(M)=11
8 THEN GOTO 95
  75 LET V(L)=PEEK(M)-28+R
 133 PRINT ,"NO"
 165 PRINT ,"YES"
```





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8K ROM
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Solving Implicit Functions on the ZX81

Basil Wentworth

Solving arithmetic and algebraic problems on the ZX81 is easy when the variable wanted is defined explicitly, that is, if you know that Y = X ** 2 + 2 * X, it is easy to program:

```
10 INPUT X
20 LET Y=X**2+2*X
30 PRINT Y
```

Now you put in the values of X and let the computer find the corresponding values of Y.

The fun begins when the variable you want is defined as an *implicit function*. Suppose, for instance, you have a value of Y for the above equation and you want to find the corresponding value of X. As a practical example, let us define a rectangle with an area of 15 square feet subject to the constraint that the length will be two feet greater than the width. This would give you the exact equation shown above, i.e., 15 = X * (X + 2) or 15 = X ** 2 + 2 * X.

This is a little hard to program. Just try telling your computer to LET 15 = X ** 2 + 2 * X.

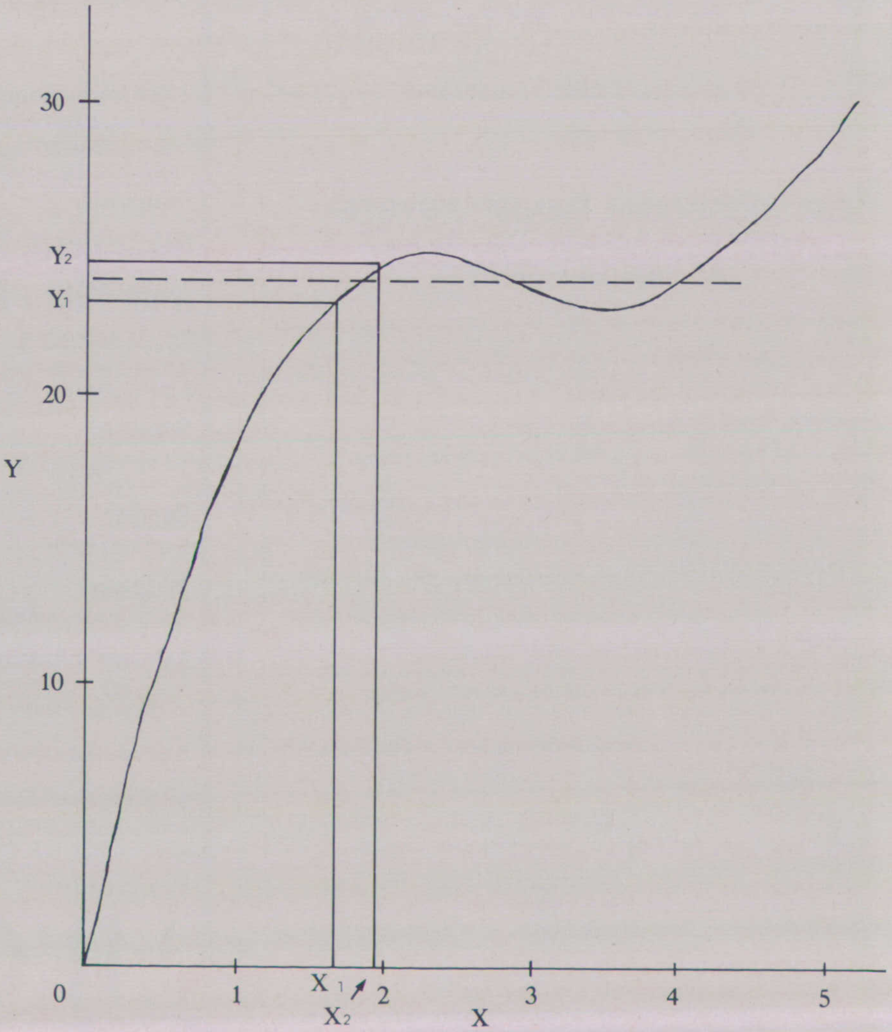
In your high school algebra class you learned some fairly easy ways to solve a quadratic equation and that is what we have here—if you remember them. But what is the use of having a computer if you are going to solve the problem by the old horse-work techniques? Or, suppose, you get something a bit more complicated like Y = X ** 3 + 3 * X ** 2 + 4 * X. Or, perhaps, Y = X * SIN X. Or, Y = (e ** X) * SIN X. It is a little harder to solve these.

The computer can handle problems of this kind by making a series of successive approximations: try out any value of X, and see if it gives the Y you want; if it does not, then try another value of X.

Basil Wentworth, 1413 Elliston Dr. Bloomington, IN 47401.

This is the sort of thing that a computer does beautifully, but you will want to give it a little guidance. If you keep pulling X's out of the hat, you may never hit on the right one; in fact, you may not even know how close you are to being right. So you want to find a systematic way of zeroing in on the right value of X.

Figure 1. Graph of Y=X3-9*X**2+26*X**



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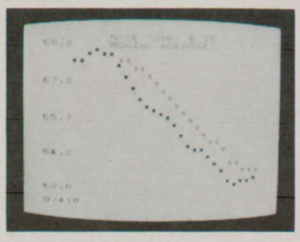

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Linear Interpolation

The method for doing this is called Linear Interpolation. Look at Figure 1 for a moment. Suppose that the solid curve shows the relationship between X and Y and that the dotted line indicates the value of Y that you are interested in. The value of X that yields this Y is found, of course, right beneath the point at which the dotted line hits the curve—somewhere between X1 and X2.

So select X1 and X2 as first approximations, find what values of Y1 and Y2 they correspond to, and then go for another estimated value of X according to what Y1 and Y2 tell you. The adjustment in X will not be strictly proportional to the error in Y unless the curve is a straight line in this region, but a proportional correction will still get you closer than you were, although on rare occasions you will come across a function that defies solution this way. Then use the new value of X as the approximate solution, and go through the process again, and again, if necessary, until you have reached the degree of accuracy you want.

Choosing your first X1 and X2 so that Y1 and Y2 surround the value is not usually imperative, but this can be helpful. In most cases, any two arbitrary approximations (as long as they are equal to each other) will suffice although some take longer to run than others.

Listing 1 contains the program to use. Type it in; press RUN and ENTER. The computer will ask you to enter the statement of the equation as Line 40. For example, the equation cited above would be entered as

40 LET Y=X**2+2*X

Then RUN 60 as the program instructs. The computer then tells you to enter a couple of guesses for X, as well as the target value for Y.

Then, as instructed, enter some tolerance figure to define the degree of accuracy that you want in the answer. Be realistic. If you ask for 0 tolerance, the computer will run all night seeking the impossible. If you specify 10% the computer will probably come a lot closer than 10%. If you call for .01%, the error seems usually to fall in the range of .001% or less. This is close enough for most practical purposes. In fact, you may want to "hard-write" (as an analogy with "hard-wire") a tolerance limit of .01% or .001% instead of entering it each time.

Listing 1. Implicit Functions (8K ROM).

```
  10 PRINT "ENTER "" 40 LET Y=F(
X)"""
  20 PRINT
  30 PRINT "THEN RUN 60"
  50 RETURN
  60 PRINT
  70 PRINT "ENTER Y"
  80 INPUT Y0
  90 CLS
 100 PRINT
 110 PRINT "ENTER FIRST APPROXIM
ATION TO X"
 120 INPUT X1
 130 CLS
 140 PRINT
 150 PRINT "ENTER SECOND APPROXI
MATION TO X"
 160 INPUT X2
 170 CLS
 180 PRINT
 190 PRINT "ENTER TOLERANCE IN P
ERCENT"
 200 INPUT T
 210 CLS
 220 PRINT
 230 LET X=X1
 240 GOSUB 40
 250 LET Y1=Y
 260 LET X=X2
 270 GOSUB 40
 280 LET Y2=Y
 290 LET X3=(X1-X2)*(Y0-Y2)/(Y1-
Y2)+X2
 300 LET X1=X2
 310 LET X2=X3
 320 IF ABS (100*(X1-X2)/X1)>T T
HEN GOTO 210
 330 PRINT "X = ";X2
```

Limitations

This technique has one limitation that may be serious in some instances. Many equations have two or more solutions, but this approach will give you only one of them. In the example given, the two solutions are: X = 3 and X = -5. In the practical cases, you are interested only in the positive values since it is rather difficult to lay off a length of -5 feet. And, if you started out with positive values for your approximations to X, the computer will give you the positive answer, but you run into trouble if more than one solution is realistic.

The curve shown in Figure 1, for example, represents the equation Y = X ** 3 - 9 * X ** 2 + 26 * X. If Y = 24, the equation has three positive roots: 2, 3, and 4. This routine will give one or another of them according to the approximate values chosen as the points of departure. If it were not for this factor, entering "hard-write" values for X1 and X2 in lines 120 and 150 would be tempting.

Another caution: do not make your first approximations too small. Above all, do not use zero. Even if you expect your answer to be zero, it is better to start with numbers like 1 or 2 to reduce the possibility of running into numbers too big for the computer to handle in line 260.

One other danger to watch out for is in the handling of negative numbers. Remember that the ZX81 is not able to raise negative numbers to powers. I suspect that this is so because the computer uses logarithms in the process, and the logarithm of a negative number baffles computer and human alike. If this danger appears to be imminent, it can be avoided by the following substitutions:

For even-numbered exponents, replace X ** n by (ABS X) ** n.

For odd-numbered exponents, replace X ** n by SGN X * (ABS X) ** n.

Remember that it is very, very likely that you will run into negative numbers when you use trigonometric functions. The same strategem will work with them.

For even-numbered exponents, use (ABS (SIN X)) ** n.

For odd-numbered exponents, use SGN (SIN X) * (ABS (SIN X)) ** n.

The program can be translated to the 4K ROM by making the following change:

```
10 PRINT "ENTER#";CHR$(212);"#40
LET Y=F(X)";CHR$(212)
```

However, the program will lose some of its appeal because of the lack of floating point arithmetic. The answers will be in whole numbers so the closeness of the approximations will be lost.

One final limitation is that this routine will not give imaginary roots, i.e., square roots of negative numbers, designated by mathematicians as i and by engineers as j. But you have little chance of running into these unless you are working with AC power or electronic circuits.

One final caution, remember that the ZX81 gives you the arguments of trigonometric functions in radians. If you want degrees, multiply the radian value by 180/PI. (*Ed. —See the article "Degrees, Grads, and Radians" elsewhere in this issue.*)

BOLEX: Beginner's Ohm's Law EXercises

Ray Stadta

Ohm's Law

George Simon Ohm (1787-1854) was a German schoolmaster who studied the electric circuit and determined the relationship of voltage, the electromotive force (E); current, the intensity of electron flow (I); and resistance, the opposition to electron flow (R). The results of his experiments were expressed in the equation E=IR which can also be expressed as I=E/R and R=E/I.

To those outside the field of electricity, this equation, now called Ohm's law, may not seem very impressive, but it plays a very important role in the design and creation of such everyday wonders as electric lights, telephones, toasters, TVs, car starters, refrigerators, and computers. Before Ohm's work, unknown values of voltage, current, or resistance had been difficult, even impossible, to find experimentally. However, these unknown circuit values can now be found quickly and accurately by mathmatical computation from Ohm's equation. Despite this contribution of great importance to electrical science, Ohm lost his teaching job.

In addition to voltage, current, and resistance the electric circuit includes a fourth element: wattage, the measure of power consumption. Wattage is found by another equation: P=IE, in which P stands for watts. Thus, watts equal current times voltage. Notice that the power equation and Ohm's equations all have the terms I and E in common. Knowing how mathematics handles equations with common terms, we can see the expanded versions in Figure 1.

BOLEX

BOLEX is a program that solves these equations two at a time. Enter the program into your computer, hit RUN and NEWLINE. Four prompts will appear on your screen: amps, volts, ohms, and watts. Type in a value for one, hit NEWLINE. Continue until the values have been entered. With two values you will be able to find the other two. Try the following sample runs:

Ray Stadta, 120 Calle Cuervo, San Clemente, CA 92672. Translated to 8K ROM by James Grosjean.

Figure 1. Ohm's Law Variations.

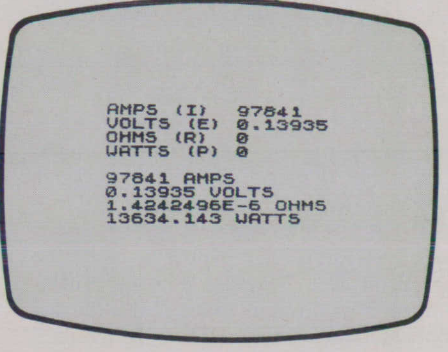
I Amps	=	$\frac{E}{R}$	$\frac{P}{E}$	$\sqrt{\frac{P}{R}}$
E Volts	=	IR	$\sqrt{PR}$	$\frac{P}{I}$
R Ohms	=	$\frac{E}{I}$	$\frac{E^2}{P}$	$\frac{P}{I^2}$
P Watts	=	IE	I^2R	$\frac{E^2}{R}$

1) An appliance circuit has a current rating of 9 amps with 120 volts applied. What is the value of resistance in ohms and the power consumed in watts? Input: amps: 9; volts: 120; ohms: 0; watts: 0. The program finds the ohms and watts by solving the equations: R=E/I and P=IE.

2) How much current is drawn and how many watts are consumed by a 120 volt heating unit with 14 ohms resistance? Input: amps: 0; volts: 120; ohms: 14; watts: 0. The amps and watts are found by solving: I=E/R and P=IE or P=E*E/R where E is small enough not to cause an arithmetic overflow.

3) How much amperage and resistance is in the circuit of an appliance that uses 1625 watts plugged into 120 volts? Input: amps: 0; volts: 120; ohms:0; watts: 1625. The program solves: I=P/E and R=E*E/P.

4) A high-voltage circuit draws 5 amps with a known resistance of 450 ohms. Find the watts and volts. Input: amps: 5; volts: 0; ohms: 450; watts: 0. The program solves: E=IR and P=IE.



Machine Limitations

The 4K ROM has three limitations for the full use of the formulas. First, it functions only with whole number arithmetic. However, the program in Listing 2 includes routines for coaxing decimals from the ZX80 for the amps computation in the following lines:

210-240: division to one decimal place.

300-370: division to three decimal places.

430-440: multiplication of a 3-place decimal with accuracy near enough to 100% for the purposes of this program.

Second, the 4K ROM does not have the SQR function so again a routine is included to do this in lines 150-230. However, this gives roots only as whole numbers.

Third, in order to provide whole numbers the 4K ROM always rounds off the number by rounding down. This means that computations involving decimal places on the 4K ROM will not have the accuracy that the 8K ROM provides.

As you use this program to work out electric current problems, remember that the Sinclair is a beginner, too, and has a limited range. If you get carried away trying to figure how many watts are used to light up Yankee Stadium for a night game, be ready for an overflow error code (6).

By the way, six years after Ohm was fired, he got recognition and a better job at the University of Munich.

Figure 2. Ohm's Law Program (4K ROM).

```
 10 PRINT "AMPS (I)##";
 20 INPUT I
 30 PRINT I
 40 PRINT "VOLTS (E)#";
 50 INPUT E
 60 PRINT E
 70 PRINT "OHMS (R)##";
 80 INPUT R
 90 PRINT R
100 PRINT "WATTS (P)#";
110 INPUT P
120 PRINT P
130 PRINT
140 GO TO ABS(150*(I+E=0)+260*(
I+R=0)+350*(I+P=0)+450*(E+R=0)+4
80*(E+P=0)+510*(R+P=0))
150 LET H=182
160 LET L=0
170 LET E=(L+H)/2
180 LET K=(P*R)/E
190 IF K=E THEN GO TO 240
200 IF H-L<2 THEN GO TO 240
210 IF K<E THEN LET H=E
220 IF NOT K<E THEN LET L=E
230 GO TO 170
240 GO SUB 280
250 GO TO 540
260 GO SUB 280
270 GO TO 330
280 LET I=P/E
290 LET X=P-I*E
300 LET Y=10*X/E
310 PRINT I;".";Y;"#AMPS"
320 RETURN
330 LET R=E*E/P
340 GO TO 540
350 LET I=E/R
360 LET M1=E-I*R
370 LET D1=10*M1/R
380 LET M2=10*M1-D1*R
390 LET D2=10*M2/R
400 LET M3=10*M2-D2*R
410 LET D3=10*M3/R
420 PRINT I;".";D1;D2;D3;"#AMPS"
430 LET P=((D1*100+D2*10+D3)/10)
*E/100+I*E
440 GO TO 540
450 LET E=P/I
460 LET R=E/I
470 GO TO 530
480 LET E=I*R
490 LET P=I*E
500 GO TO 530
510 LET R=E/I
520 LET P=I*E
530 PRINT I;"#AMPS"
540 PRINT E;"#VOLTS"
550 PRINT R;"#OHMS"
560 PRINT P;"#WATTS"
```

Figure 3. Ohm's Law Program (8K ROM).

```
 10 PRINT "AMPS (I)   ";
 20 INPUT I
 30 PRINT I
 40 PRINT "VOLTS (E)  ";
 50 INPUT E
 60 PRINT E
 70 PRINT "OHMS (R)   ";
 80 INPUT R
 90 PRINT R
100 PRINT "WATTS (P)  ";
110 INPUT P
120 PRINT P
130 PRINT
140 GOTO (150*(I+E=0)+180*(I+R=
0)+210*(I+P=0)+240*(E+R=0)+270*(
E+P=0)+300*(R+P=0))
150 LET E=SQR (P*R)
160 LET I=P/E
170 GOTO 320
180 LET I=P/E
190 LET R=E*E/P
200 GOTO 320
210 LET I=E/R
220 LET P=I*E
230 GOTO 320
240 LET E=P/I
250 LET R=E/I
260 GOTO 320
270 LET E=I*R
280 LET P=I*E
290 GOTO 320
300 LET R=E/I
310 LET P=I*E
320 PRINT I;" AMPS"
330 PRINT E;" VOLTS"
340 PRINT R;" OHMS"
350 PRINT P;" WATTS"
```

ZX81 · TS1000

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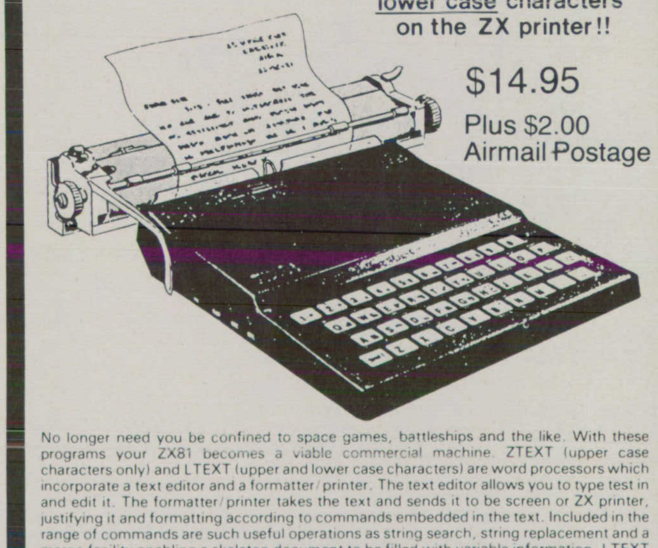

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Repeat Key Option *George R. Ingle*

Ed.—**A WORD OF CAUTION:** *Any hardware project for your computer must be approached with extreme caution.* **SYNC** *cannot be responsible for any problem that may arise from attempting hardware projects. Obviously, any damage to your computer can be costly in time and money.*

A repeat key option is relatively simple to build and install. In addition to IC sockets, wire, and a suitable mounting board, one of each of the following parts is required:

555 timer IC.

74LS244 octal non-inverting tri-state bus driver.

100uF miniature electrolytic capacitor rated 15v or greater.

1K ohm resistor rated 1/4 watt.

5 or 10K miniature POT.

SPDT miniature switch.

The steps in construction are as follows:

1) Connect all components. Lead lengths and component placement are not critical. Good soldering practices should be followed, as usual. See Figure 1.

Figure 1: Typical Diode.

Typical Diode

D1C=Diode 1 Cathode
D1A=Diode 1 Anode
etc. for all connections

2) *Carefully* de-solder and remove the eight 1n4148 diodes in series with the keyboard contacts. These diodes are soldered to the computer printed circuit board in plated-through holes. You must be very careful not to damage the signal line connects to these holes. On the Sinclair these diodes are numbered D3 through D10; on the MicroAce, D1 through D8.

3) *Carefully* solder the wires to the diode holes as shown. Make sure that solder flows through the holes and makes a good connection.

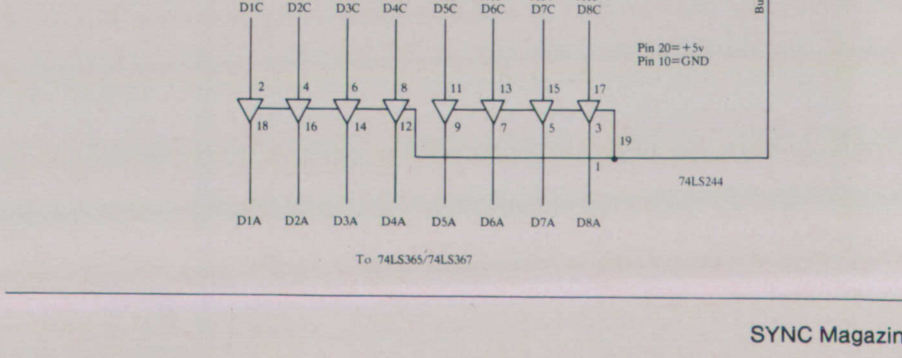
4) Connect the chip grounds and 5v pins to a place on the circuit board. Just about any connection supplying the necessary voltages can be used except the 5v input to the VHF/UHF modulator. This would result in unwanted "noise" created by the 555 timer being sent to the TV and causing distortion in the display.

5) Install and connect the switch. This switch allows you to select the repeat function or to return the keyboard to its normal operating state. The logic low KBD signal can be tapped at pin 1 on IC 10 for the Sinclair or pin 1 on IC 11 for the MicroAce. This keyboard signal, when connected to the 74LS244 allows normal operation of the keyboard. See Figure 2.

6) Set the repeat rate or frequency by adjusting the 5 or 10K POT. The repeat rate selected will remain stable, but keep in mind that the repeat rate will be slower on a ZX81 or MicroAce equipped with the video upgrade operated in the slow mode since these machines insert additional delays generated by the retiming character display frequency. Too high a repeat rate will make you "outrun" the keyboard scan frequency used by the Z80 during an IORQ and RD. This will not be a problem since the rate at which this occurs is very difficult to follow with your eyes! ■

George R. Ingle, 24593 1/2 Monterey Ave., San Bernadino, CA 92410.

Figure 2: Schematic for Keyboard Repeater.



8K ROM
1K RAM

Degrees, Grads, and Radians

Alvin Lam

There are three methods of measuring angles: degrees, grads, and radians. However, the ZX81 with all its new trigonometric functions can only measure angles in radians. You can convert a measurement by any of the three methods to either of the remaining methods with the few short programs given in the listings below. You may want to add a REM statement to identify each listing for use in a program.

Type in the program you need. Hit RUN and ENTER. One prompt will appear on the screen, e.g., in Listing 1, RADIANS=. Type in the number of radians you want converted to degrees and press ENTER. The answer will appear.

Alvin Lam, 690 Sunset Pkwy., Novato, CA 94947.

Listing 1: Radians to Degrees.

```
10 PRINT "RADIANS=";
20 INPUT R
30 PRINT R
40 LET D=R*180/PI
50 PRINT "DEGREES=";D
60 STOP
```

Listing 2: Degrees to Radians.

```
10 PRINT "DEGREES=";
20 INPUT D
30 PRINT D
40 LET R=PI*D/180
50 PRINT "RADIANS=";R
60 STOP
```

Listing 3: Radians to Grads.

```
10 PRINT "RADIANS=";
20 INPUT R
30 PRINT R
40 LET G=63.661977*R
50 PRINT "GRADS=";G
60 STOP
```

Listing 4: Grads to Radians.

```
10 PRINT "GRADS=";
20 INPUT G
30 PRINT G
40 LET R=G/63.661977
50 PRINT "RADIANS=";R
60 STOP
```

Listing 5: Degrees to Grads.

```
10 PRINT "DEGREES=";
20 INPUT D
30 PRINT D
40 LET G=D/.9
50 PRINT "GRADS=";G
60 STOP
```

Listing 6: Grads to Degrees.

```
10 PRINT "GRADS=";
20 INPUT G
30 PRINT G
40 LET D=G*.9
50 PRINT "DEGREES=";D
60 STOP
```

8K ROM
1K RAM

Rounding Off with Conditional Tests

James E. Stauffer

We have all learned in plane geometry classes the Pythagorean theorem: *a* squared plus *b* squared equals *c* squared. Thus, if we know two sides of a right triangle, we can easily calculate the third. Or can we?

My son pointed out a Basic program for finding "Pythagorean triples" in his geometry textbook (Jurgensen, Donnelly, Maier, and Rising. *Geometry*. Boston: Houghton Mifflin Co., 1978). These are the solutions to a right triangle when all three sides are positive integers. I translated the program into ZX81 Basic as follows:

```
10 FOR A=1 TO 20
20 FOR B=A TO 20
30 LET C=SQR(A*A+B*B)
40 IF C< >INT C THEN GOTO 60
50 PRINT A;TAB 5;B;TAB 10;C
60 NEXT B
70 NEXT A
```

James E. Stauffer, 6076 Chinaberry Dr., Columbus, OH 43213.

Then we ran the problem, and the display appeared as follows:

```
8  15  17
0/70
```

This result was a surprise. What had happened to the famous 3, 4, 5 triangle, let alone all the other solutions we were sure were there? It was obvious from the display that the program was working and that it had exhausted all possible values of A up to 20, stopping at line 70.

The problem had to be in the conditional test in line 40 which says in effect, "PRINT only solutions in which C is an integer." Some of the obvious solutions must be failing the test.

We decided to see what was happening by going to the immediate mode, i.e., entering text without line numbers, and typed:

```
LET A=3
LET B=4
LET C=SQR(A*A+B*B)
PRINT C
```

The screen display showed 5, which is an integer, or is it? Knowing that some algorithms, such as SQR, produce round-off errors, we next tried:

```
PRINT C-INT C
```

The number 1.8626452E-9 appeared. Here was the problem. A tiny error, outside the display range of the ZX81 had caused many solutions to fail the conditional test of line 40, which demands that INT C be *exactly* equal to C. The solution then was to rewrite line 40 to permit small errors in the SQR solution for C:

```
40 IF C-INT C>0.000001 THEN GOTO 60
```

When we ran the problem with this change, we got the following results:

```
3   4   5
5  12  13
6   8  10
8  15  17
9  12  15
12 16  20
15 20  25
0/70
```

These are the proper solutions for all Pythagorean triples for sides A and B less than or equal to 20.

ZX81 users must be prepared to accept slight imperfections when the computer is dealing with non-arithmetic functions. The algorithms used are powerful, but some round-off errors may be present.

Block Transfers: Horizontal Scrolling on your 1K ZX81

John Scher

A programming technique called block transfers of memory adds new possibilities for your programming and for taking advantage of your computer's capabilities. Although the technique involves the use of machine language, this article assumes only that you are familiar with the Sinclair manual *ZX81 BASIC Programming* and that you are willing to work with hexadecimal. Dr. Ian Logan's article, "An Introduction to Machine Language" (*SYNC* 1:6) is helpful, but not essential.

For some readers learning may be its own reward. For those who want a more concrete incentive, this article will show how to modify Douglass D. Sharp's LSCROLL routine (*SYNC* 2:2) for a 1K machine. Using this routine, you will be able to launch a fleet of jets, in formation, across your TV screen . . . that is, after a little homework.

What is a Block Transfer?

We must begin by defining a block of memory. This is the information held in a set of sequential addresses in the memory of the computer. The contents of a REM statement, for example, constitute such a block. A block transfer of this information would write the contents of the block into a different area of memory. That is, the sequence is reproduced at a new starting address. Furthermore, the original sequence is not disturbed unless the "source" and "destination" areas overlap.

RAMTOP

To use this programming technique, we must first understand the systems variable called RAMTOP. Reviewing the information on RAMTOP in *ZX81 Basic Programming*, Chapter 26, would be helpful at this point. The discussion below draws on this chapter and supplements it.

John Scher, 222A Hamilton St., Cambridge, MA 02139.

When you turn on the ZX81, it tests to see how much memory it has to work with and then stores the address of the first non-existent byte for future reference. This address is called RAMTOP. It is stored at addresses 16388 and 16389. For example, if you have 1K RAM, type:

PRINT PEEK 16388+256*PEEK 16389

and ENTER. This will tell you that the address of the first non-existent byte is 17408. This is RAMTOP.

You can change RAMTOP by POKEing the appropriate values into addresses 16388 and 16389 then typing NEW and ENTER. For example, suppose that you want to establish RAMTOP at 17388. You would type POKE 16388,236 and ENTER; then POKE 16389,67 and ENTER, and then NEW and ENTER. These values produce the new RAMTOP address by the following calculation:

236+256*67=17388

This POKEing will fool the machine into thinking that there is no usable memory above RAMTOP (17388).

As a result nothing above that address will be disturbed by the Basic system. The area above RAMTOP is also undisturbed by LOADing a new program into the machine. The usefulness of this area cannot be overemphasized because it gives the user a place to store machine code, Basic data arrays, and other memory blocks. These are then available for use in multiple Basic programs without having to type in the machine code or data each time you want to use it.

The only disadvantage of this area is that it is not saved by SAVE. This is why block transfers are so useful. They allow the transfer of information from a SAVEable area of memory to one that is undisturbed during program LOADing.

A Basic Program for a Block Transfer

Figure 1 shows a block transfer program in Basic. This program locates the bytes, in this case X's, in the REM statement and transfers them to a new starting address. The address of the first X in the REM statement is 16514. Before using such a program to place machine code bytes above RAMTOP, you must first reserve space above RAMTOP as we have already discussed.

The bytes in Figure 1 could just as easily be in an array or another Basic variable. Either of these would be similarly SAVEable, although locating the starting address for a block transfer would be a bit more difficult.

Figure 1. A Basic Program for Block Transfer.

```
 1 REM XXXXXXXXXX
10 FOR N=0 TO 9
20 POKE 17398+N,PEEK (16514+N)
30 NEXT N
```

The LDIR Instruction

Given that much of the work of a computer is moving things from one address to another, it is not surprising that the Z80(A) microprocessor has a command that can accomplish a block transfer much more quickly and efficently than a Basic program like that in Figure 1. This is the "Repeating Block Load With Increment" instruction, LDIR. The LDIR instruction makes use of three register pairs: BC, DE, and HL. Initially, the BC register pair must hold the number of bytes that you want to transfer, just like the FOR-NEXT loop in Figure 1. The DE pair holds the first address in the "destination" block of memory, and the HL pair holds the first address in the "source" block of memory. The LDIR instruction transfers the contents of the address held in the HL pair to the address held in the DE pair. Then it increments HL and DE (i.e., adds 1) and decrements BC (i.e., subtracts 1). It then compares the BC pair to zero, and, if BC is not equal to zero, the instruction is repeated, otherwise the next instruction is executed.

Although we will use LDIR in the sample programs in this article, you should know that LDIR has a cousin, LDDR, which is similar except that it decrements all three registers. You might think about which of these two you would use to transfer overlapping memory blocks.

An Overview of the Process

At this point let me summarize what we are going to do. We will enter a machine code block transfer program along with a sample machine code routine to be transferred into the space above RAMTOP. Then we will transfer this block of memory to a SAVEable REM statement. At this point, a few modifications will be made, and then we will try out LSCROLL with a sample Basic program. There are slightly easier ways to achieve the same end result, but this sequence will teach you the most.

A Machine Language Block Transfer

The first step in entering the machine language block transfer program is to reserve 184 bytes above RAMTOP by typing POKE 16388,72 and ENTER, then POKE 16389,67, and ENTER, and then NEW and ENTER. Now that you have reserved the necessary space above RAMTOP, enter the hex loading program shown in Figure 2 (from Booth, "The Game of Life Revisited," *SYNC* 2:1, p. 20).

When you RUN this program, the screen will prompt you for a byte in hexadecimal. Refer now to Figure 3, which lists the block transfer machine code. Note that the first nine bytes (contained in addresses 17224-17232) set up the BC, DE, and HL register pairs (LD stands for load) as discussed above. The next two bytes perform the transfer, and the last returns the computer to Basic. Note that all addresses within an LD instruction, for example, 4082h = 16514d, are entered lower-order-byte first, higher-order-byte second, in the same manner used to change RAMTOP. Remember that a 0 in a hexadecimal listing such as in Figure 3, column 2, is always a zero and never the letter O.

Now that the screen is prompting you for an entry, enter the bytes in Figure 3, column 2 (i.e., type 01 and ENTER, then B8 and ENTER, etc.). Then go directly to Figure 4 without typing RUN and continue by entering the LSCROLL sequence. The parentheses and asterisks will be explained later. For now just

Figure 2. Hex Loading Program.

```
 200 LET V=-1
 210 LET V=V+1
 220 IF INT (V/50)*50=V THEN CLS

 230 IF INT (V/10)*10=V THEN PRI
NT
 240 INPUT H$
 250 IF H$="" THEN GOTO 240
 260 PRINT H$;"#"
 270 IF H$="END" THEN STOP
 280 IF H$="/" THEN GOTO 310
 290 POKE 17224+V,16*CODE (H$)+C
ODE (H$(2))-476
 300 GOTO 210
 310 LET V=V-1
 320 GOTO 240
```

Figure 3. The Block Transfer Machine Code.

Decimal Address	Hex Code	Instructions
17224	01	LD BC,#of bytes
17225	B8	00B8h=184d
17226	00	
17227	11	LD DE,destination
17228	82	4082h=16514d
17229	40	
17230	21	LD HL,source
17231	48	4348h=17224d
17232	43	
17233	ED	LDIR(transfer)
17234	B0	
17235	C9	RET(return)

Figure 4. The LSCROLL Sequence.

```
17236-17407  ENTER  the LSCROLL
sequence:    3A(FE.43)FE.16.DA(61
.43)3E.00.32(FE.43)3A(FF.43)D6.0
0.CA(71.43)FE.15.D2(71.43)C3(76.
43)3E.16.32(FF.43)F5.3A(FF.43)47
.F1.3A(FE.43)80.FE.16.DA(95.43)2
6.00.2E.16.3A(FE.43)4F.06.00.ED.
42.7D.32(FF.43)ED.5B.0C.40.0E.FF
.F5.3A(FE.43)6F.F1.26.00.06.00.1
A.FE.76.CA(AF.43)13.C3(A5.43)0C.
A7.E5.ED.42.E1.CA(BC.43)13.C3(A5
.43)06.00.F5.3A(FF.43)4F.F1.C5.D
5.E1.23.7E.FE.76.C2(C7.43)E5.A7.
ED.52.2B.7D.4D.D6.00.E1.C2(E0.43
)E5.D1.C3(F5.43)3D.C2(E8.43)13.C
3(F1.43)06.00.0B.13.D5.E1.23.ED.
B0.3E.00*12.13.C1.0B.79.D6.00.C2
(C4.43)C9.00*00*
```

Figure 5. Changes for Transfers from REM to above RAMTOP.

Decimal Address	Hex Code	Code Changes	Instructions
16514	01		
16515	B8	→AC=172d	,change #bytes
16516	00	→00	,no change
16517	11		
16518	82	→54= 84d	,change dest.
16519	40	→43= 67d	,4354h=17236d
16520	21		
16521	48	→8E=142d	,change source
16522	43	→40= 64d	,408Eh=16526d
16523	ED		
16524	B0		
16525	C9		

ignore them (i.e., type 3A and ENTER, then FE and ENTER, then 43 and ENTER, etc.). If you make a mistake while entering this machine code, note that line 280 in Figure 2 gives you a backspace key, "/". When you are done entering the machine code in Figure 4, type END and ENTER, and the loading program will STOP. At this point you should check to be sure that you did not leave out a byte or two accidently by typing PRINT PEEK 17405 and ENTER. The number 201 should appear at the top of your screen (201d = C9h). Congratulations if you have come this far without leaving anything out!

Next, SAVE the hex loading program for future use. Then type NEW and ENTER to clear out the memory for the REM statement that we will use as the destination block of memory. Put the computer into FAST mode to enter the REM statement, otherwise it will take forever. Type 1 REM and then 184 X's, as in Figure 1, and ENTER. You can change back to SLOW mode now.

Transferring LSCROLL

Now you are ready for the block transfer. Type RAND USR 17224 and ENTER. The transfer will occur so fast that you will think that you made a mistake. Type ENTER again and you will see the first few bytes of machine code in the REM statement. If this does not occur you had better PEEK a few addresses between 17224 and 17235 to look for mistakes.

Before you SAVE the REM statement, a few changes must be made so that in the future, when you LOAD the program, the block transfer will work in the other direction, that is, it will transfer LSCROLL from the REM statement to above RAMTOP. Also, the first twelve bytes need not be transferred because they make up the block transfer routine, not the LSCROLL routine. Figure 5 shows the changes you must make. Column 1 lists the addresses that the block transfer machine code routine occupies in the REM statement, and column 2 is identical to column 2 in Figure 3 for comparison. Column 3 gives the decimal values which must be POKEd in. Type POKE 16515,172 and ENTER, then POKE 16518,84 and ENTER, etc. until you have POKEd all five changes in. *Now* SAVE "LSCROLL".

In the future, when you want to use LSCROLL, reserve 172 bytes above RAMTOP (POKE 16388,84; POKE 16389,67; NEW), then LOAD "LSCROLL" and transfer it to the space above RAMTOP by typing RAND 16514. In fact, you should do this now to reclaim the twelve bytes of memory above RAMTOP that were needed before to make the block transfer to the REM statement. You will need all the memory available for the sample Basic program in Figure 6.

Using LSCROLL from above RAMTOP

Once you have LSCROLL above RAMTOP, type NEW and ENTER to get rid of the REM statement. Now you have enough space to enter the Rockets program in Figure 6. Note that the Rockets program POKES three addresses in the LSCROLL routine, 17394, 17406, and 17407. These addresses correspond to the bytes in Figure 4 that are followed by asterisks. The function of these addresses is as follows:

Figure 6. Rockets Program Listing.

```
 1 REM ROCKETS
 4 POKE 17394,14
 5 FOR H=6 TO 14
10 PRINT AT H,31;"<"
15 NEXT H
17 FOR M=0 TO 4
20 POKE 17406,10-M
30 POKE 17407,1+2*M
35 FOR N=0 TO 32
40 RAND USR 17236
45 NEXT N
50 NEXT M
60 CLS
70 GOTO 5
```

17394 specifies the code for the character which will occupy the new spaces created by LSCROLLing.

17406 specifies the line number at which to begin LSCROLLing; POKE in a number from 0 to 21; see *ZX81 BASIC Programming*, p. 89.

17404 specifies the number of lines to be LSCROLLed, including the first one; POKE in a number from 1 to 22.

Add 1024 to these addresses if you have 2K RAM (see below). Rockets calls the LSCROLL routine with the line 80 RAND USR 17236 since the starting address of the LSCROLL routine is 17236.

Now comes the moment of truth. RUN Rockets. If you have come this far without making a mistake, you will see a line of jets form on the right side of the screen and take off across the screen in formation, leaving their contrails behind.

For More Than 1K RAM

Those with more than 1K RAM may want to locate LSCROLL at a higher starting address. For instance, if you have added 1K for a total of 2K RAM, you have an additional 1024 bytes. Therefore you could move RAMTOP to 18260 (17236 + 1024) for the final run which only requires 172 bytes. Do not forget that the hex loading program requires 184 bytes above RAMTOP. You will have to make these changes to move RAMTOP.

First, add 1024 to the following addresses in the figures:

Figure 2: Line 290.

Figure 3: all addresses in column 1.

Figure 6: Rockets Program: all addresses.

Next you must change some of the machine code.

Figure 3, column 2: change the 9th byte from 43 to 47.

Figure 5, column 3: 43 = 67d to 47 = 71d. Note that we have been adding 4 to the higher-order-byte of a series of addresses because 1024/256 = 4.

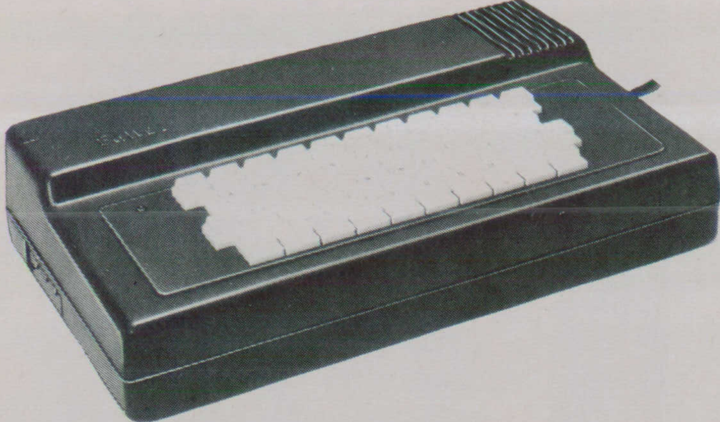
Figure 4: The parentheses contain addresses of information or routines within the LSCROLL program. For instance, the first parenthesis (FE.43) contains address 43FEh = 17406d. Add 4 to the higher-order-byte, 43, in all the parentheses. Thus the first parenthesis should read (FE.47). The program is ready for use at the starting address, 18260.

If you have more than 2K, make sure that you understand the changes suggested for 2K users, then give the changes best for your machine a try. One last word of caution: look over the article and write in the changes you will want to make in the addresses in the text, as well as the addresses referred to in the figures.

As you can see, LSCROLL is a superb program in that it allows the user to chose exactly which part of the screen to scroll. You are now ready to try some of your own programs with the LSCROLL routine. The program has many other virtues that are detailed by the author, and I give it the highest rating of any machine code program that I have seen in *SYNC*. ■

FULLER FD SYSTEM $79.95

Professional Keyboard & Case for Sinclair ZX81/TS-1000



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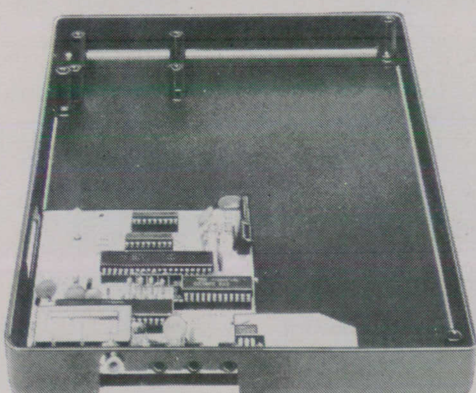

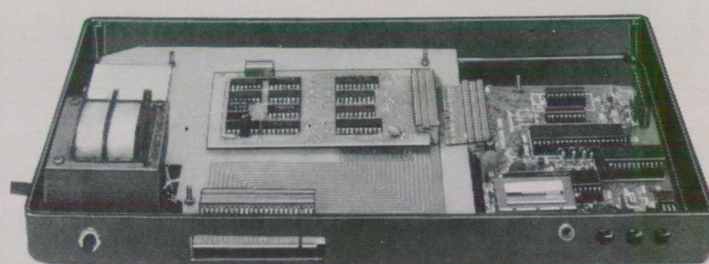

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	FD 64K. Memory Module	149.96		
	FD PSU 9 Volts at 2 amp.	14.95		
	FD *Shipping and Handling*	6.00		

Mail to **FULLER MICRO SYSTEMS,**
The ZX Centre, Sweeting Street, Liverpool 2. England, U.K.

Name ....

Address ....

City/State/Zip ....

† US Dollars

4K ROM
2K RAM

Chase

Kenneth Yu

Chase is a game of survival. The object is to survive as long as you can. You are set in a playing field, shown as a 20x10 block on your TV screen, surrounded by a lethal fence. Mines are scattered about in the field. You are being chased by five robots which will move straight toward you by means of their unerring sensors. You must destroy them before they destroy you; however, your only weapon is the minefield itself. Thus you must maneuver so that the mines will destroy the pursuing robots. But, beware! You also can be destroyed by touching the mines or the fence. Your energy goes up by one as each robot is destroyed. "H.S." means the highest score in previous games. Staying alive means that you must destroy as many robots as possible and hence beat the highest score. When your energy is higher than the H.S. shown, your energy will become the highest score in the next game. (At this point you may want to save the program again with the new high score.) If you are successful in destroying the five robots, you will be transported to another 20x10 field with a new mine configuration and five more robots chasing you.

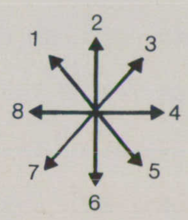
Because of the limited space, this program is a hybrid of machine language and Basic. By using machine language, the time that it takes to print the whole image along with the calculations is less than two seconds. Changes of the pattern during the game are POKEd directly into the screen instead of printing the whole pattern again.

The symbols used are:

+ (in inverse video)	= robot
* (in inverse video)	= you
X	= fence or mines
■	= fence

Kenneth Yu, 1145 West 32 Ave., Vancouver, B.C. V6H 2H8, Canada.

You control your movements by pressing the number keys according to the following diagram:



Directions:

1) Enter Listing 1, lines 1-660. At this point SAVE the program and SAVE it frequently from here on.

2) From this point on do not press RUN, CLEAR, HOME, or LIST without a line number.

3) Type in Listing 2. Then enter GOTO 2000 without a line number and press NEWLINE.

4) Enter the values in Listing 3. After each number hit NEWLINE (do not enter the commas). This must be done very carefully.

5) Type in Listing 4. Enter GOTO 2000 without a line number and press NEWLINE.

6) Type in Listing 5. Then enter GOTO 2000 without a line number and press NEWLINE.

7) Delete lines 2000-2010 by typing just the number and NEWLINE.

8) Type in with no line numbers:
LET F=100 and NEWLINE
LET G=0 and NEWLINE

8) You are now ready to embark on the *Chase*. Press GOTO 50, and the *Chase* field will appear.

9) If you want a hyperspace leap, add the following lines:

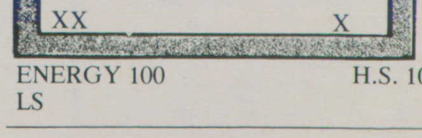
```
365 IF Y=10 THEN LET C=RND(18)
367 IF Y=10 THEN LET B=RND(8)
```

However, you must shorten the print statements to accommodate these lines.

10) For those who want to modify the program:

USR(16427):
prints the outside fence of the field.
USR(16482):
gives the memory location of the screen.$
USR(16487):
increments the units of memory. ■

Sample Run



ENERGY 100 H.S. 100
LS

Listing 1.

```
   1 REM 12345678901234567890123
45678901234567890123456789012345
6789012345678901234567890
  10 PRINT "YOU HAVE DESTROYED T
HE ENEMY"
  20 INPUT A$
  50 FOR D=1 TO 21
  60 LET A(20*E(D)+F(D))=0
  70 NEXT D
  80 IF G=5 THEN GOTO 110
 100 LET K=100
 110 LET G=0
 120 RANDOMISE
 130 LET A=USR(16427)
 140 PRINT "ENERGY=";K,"H.S.";F
 150 FOR D=1 TO 21
 160 LET C=RND(18)
 170 LET B=RND(8)
 180 LET M=20*B+C
 190 IF A(M) THEN GOTO 160
 200 LET A(M)=61
 210 IF D<6 THEN LET A(M)=147
 220 IF D=6 THEN LET A(M)=148
 230 LET E(D)=B
 240 LET F(D)=C
 250 POKE USR(16482)+M+B, A(M)
 260 NEXT D
 270 LET B=E(6)
 280 LET C=F(6)
 290 LET M=20*B+C
 300 LET A(M)=0
 310 INPUT Y
 320 IF Y THEN POKE USR(16482)+M
+B,Ø
 330 IF Y=1 OR Y=2 OR Y=3 THEN L
ET B=B-1
 340 IF Y=5 OR Y=6 OR Y=7 THEN L
ET B=B+1
 350 IF Y=1 OR Y=8 OR Y=7 THEN L
ET C=C-1
 360 IF Y=3 OR Y=4 OR Y=5 THEN L
ET C=C+1
 370 LET M=20*B+C
 380 IF A(M)=61 THEN PRINT "YOU#
TOUCHED THE FENCE"
 390 IF A(M)=147 THEN PRINT "YOU
#BUMPED INTO THE ENEMY"
 400 IF A(M)=147 OR A(M)=61 THEN
#GOTO 660
 410 POKE USR(16482)+M+B,148
 420 LET A(M)=148
 430 LET E(6)=B
 440 LET F(6)=C
 450 FOR D=1 TO 5
 460 LET M=20*E(D)+F(D)
 470 IF A(M)-147 THEN GOTO 610
 480 LET A(M)=0
 490 POKE USR(16482)+M+E(D),0
 500 IF E(D)<B THEN LET E(D)=E(
D)+1
 510 IF E(D)>B THEN LET E(D)=E(
D)-1
 520 IF F(D)<C THEN LET F(D)=F(
D)+1
 530 IF F(D)>C THEN LET F(D)=F(
D)-1
 540 LET M=20*E(D)+F(D)
 550 IF A(M)-61 THEN POKE USR(1
6482)+M+E(D),147
 560 IF A(M)=148 THEN PRINT "YO
U HAVE BEEN DESTROYED"
 570 IF A(M)=0 OR A(M)=148 THEN
#GOTO 610
 580 LET K=K+1
 590 LET G=G+1
 600 LET A=USR(16487)
 610 IF A(M)=0 THEN LET A(M)=14
7
 620 IF G=5 THEN GOTO 10
 630 IF A(M)=148 THEN GOTO 660
 640 NEXT D
 650 GOTO 270
 660 IF K>F THEN LET F=K
```

Listing 2.

```
2000 FOR X=16427 TO 16506
2001 INPUT A
2002 PRINT A,
2003 POKE X,A
2004 NEXT X
```

Listing 3.

```
42,12,64,35,205,74,64,6,8,197,
54,9,35,6,18,54,0,35,16,251,54,
9,35,62,117,60,119,35,193,16,
234,6,20,54,9,35,16,251,62,117,
60,119,35,34,14,64,34,16,64,62,
13,50,37,64,201,42,12,64,35,201,
42,12,64,6,0,14,220,9,126,254,
37,40,02,52,201,54,28,43,24,244
```

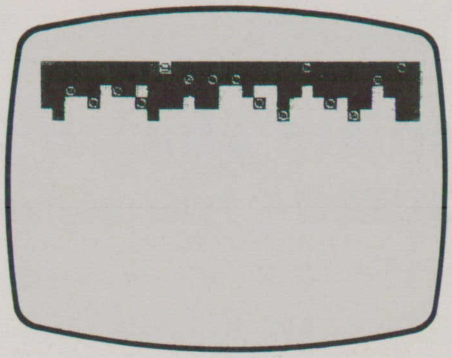
Listing 4.

```
2000 DIM E(21)
2001 DIM F(21)
2002 FOR D=1 TO 21
2003 LET E(D)=0
2004 LET F(D)=0
2006 NEXT D
```

Listing 5.

```
2000 DIM A(200)
2001 FOR B=0 TO 9
2002 FOR C=0 TO 19
2003 LET M=20*B+C
2004 LET A(M)=0
2006 IF B=0 OR B=9 OR C=0 O
R C=19 THEN LET A(M)=61
2008 NEXT C
2010 NEXT B
```

8K ROM
1K RAM



Space Taxi

Neil Dewhurst

You are the pilot of a space taxi in the year 2081. You have just picked up a fare who must catch the next ship to Zeta Chi LXXXI. Naturally, there is a big tip if you make it in one piece. You control your taxi by the 6 and 7 keys to avoid the buildings and the other traffic (which appears to be standing still because you are going so fast). If you crash before getting to the spaceport, the space odometer will show how many blocks you passed before the crash.

Type in the program and then SAVE it before playing. After SAVEing, hit SLOW and ENTER. Your taxi is immediately underway. So be prepared to drive with the 6 and 7 keys.

Graphics note:
Line 60: inverse space.
Line 150: inverse graphic on M.
Line 1010: inverse space.
Line 1030: inverse O.

Neil Dewhurst, 2 Chesterbrook, Ribchester, Nr. Preston PR3 3XT, U.K.

```
  10 LET S=0
  20 LET Y=2
  30 LET X=0
  40 CLS
  50 GOSUB 1000
  60 PRINT AT Y,X;"█"
  70 LET D=0
  80 IF INKEY$="7" THEN LET D=-1
  90 IF INKEY$="6" THEN LET D=1
 100 LET S=S+1
 110 LET X=X+1
 120 IF X=31 THEN GOTO 30
 130 LET Y=Y+D
 140 IF Y<1 THEN LET Y=1
 150 PRINT AT Y,X;"█"
 160 PRINT AT Y,X+1;
 170 IF PEEK (PEEK 16398+256*PEE
K 16399)=128 THEN GOTO 60
 180 PRINT S
 190 INPUT J$
 200 RUN
1000 FOR J=0 TO 31
1005 FOR I=1 TO 2+INT (RND*4)
1010 PRINT AT I,J;"█"
1015 NEXT I
1020 NEXT J
1025 FOR I=1 TO 15
1030 PRINT AT INT (RND*5)+1,I*2;
"█"
1035 NEXT I
1040 RETURN
```

The Complete Sinclair ZX81 Basic Course

Fred Blechman

The Complete Sinclair ZX81 Basic Course. Published by Beam Software, U.K. and Australia. 255 pages; softbound with two hole punched pages and two rings. In U.S. available from Softsync for $35; two program cassettes, $5.

It has been said, 'It's not what something costs that counts; it's what it's WORTH!' That certainly seems true in the case of *The Complete Sinclair ZX81 Basic Course*. You get 255 pages of 8-1/4' x 5-1/2' two-hole punched sheets held together by two rings in a fancy vinyl cover. Thirty-five dollars for this? It looks like a real ripoff!

Further inspection does not help. No author's name is given—just Beam Software, with publishers in England and Australia. Look in the back for an index, and you will not find one. Look in the front for a table of contents, and you find a single page headed 'INDEX.'

First impressions, however, can be deceiving.

The course begins with the assumption that you know practically nothing about computers or programming and holds your hand pretty tightly. If you are a beginner, you should go through each example with your ZX81 at your side. However, later chapters go into depth on some very valuable material for those intending to do significant programming on the ZX81.

Chapter 1 starts with simple programming that a beginner really should be able to follow. This is unlike many so-called beginner's books. Chapter 2 explains simple flowcharting. Chapters 3 and 4 go into arithmetic operations and functions in depth with examples to explain the purpose of various functions while avoiding mathematical theory.

Chapters 5 and 6 do a great job of explaining strings and string functions, including 'slicing' and substring handling. Chapter 7 covers editing with more information than the Sinclair manual. However, it should have gone into more depth since efficient editing can be a real timesaver in programming. Chapters 8 and 9 explain loops and conditional statements well. Chapter 10 covers arrays, both simple and string. This is a subject of immense importance in the ZX81 since READ/DATA are not provided.

Chapters 11 through 15 cover subroutines, character codes and graphics, FAST and SLOW operation, screen formatting, graphic layout, INKEY$, and PAUSE.

Chapter 16 describes procedures for using a cassette recorder to store and retrieve programs, and Chapter 17 discusses a programming method known as "top down programming." Chapter 18 has an excellent discussion of debugging programs along with expanded explanations of what the 15 ZX81 errors codes really mean.

Chapters 19 through 22 get into the high ground of memory saving techniques, machine code programs, system variables, and advanced graphics. These chapters are definitely not for beginners, but greatly increase the value of this book for non-beginners. PEEK, POKE, and USR are illustrated with line renumber and memory-size machine language programs cleverly hidden in REMark statements at the beginning of a Basic program. The various system pointers are discussed in sufficient detail to help you understand the very peculiar goings-on "under the hood," including the wild antics of the elastic display file of the 1K ZX81. For those schooled in a different memory access, such as the TRS-80, this will be a real education! These chapters are just loaded with information either not available or well-hidden in the Sinclair Manual.

The three appendices include the standard 255 character set with all keywords, a priority listing for program operations, and several application programs that implement the techniques described in the book.

The last 78 pages are a reference manual of all 64 ZX81 keywords, with a page or more of explanation devoted to each. For beginners and those not acquainted with some of the peculiarities of Sinclair 8K Basic, these pages are a treasure that can save a great deal of time and avoid much frustration, especially in translating programs from other Basics. This section alone may be worth the price of the book.

Two cassettes, containing 18 programs from the book, are available separately. They loaded and ran perfectly. This saved a great deal of keyboard and debugging time.

If you have any interest in learning to program your ZX81, especially if you are new in computing, I would recommend this course highly. If you are already a user, you probably do not need it. Instead you might buy ready-to-go programs and just enjoy!

Fred Blechman, 7217 Bernadine Ave., Canoga Park, CA 91307.

ZX81 Chess vs. ZX Chess II

Martin Wren-Hilton

SYNC

SOFTWARE PROFILE

Name of Package: ZX81 Chess.
ZX Chess II.

Type: Board Games

System: Sinclair 8K ROM; 16K RAM

Format: Cassette

Summary: Two powerful chess programs

Price: ZX81 Chess: £9.50.
ZX Chess II: £15.00

Manufacturer:
(ZX81 Chess)
Micro-Gen
24 Agar Crescent
Bracknell, Berkshire, U.K.

(ZX Chess II)
Artic Computing
396 James Reckitt Ave.
Hull, North Humberside, U.K.

Computer chess is becoming a very popular hobby for those who cannot find opponents on their level, and a large number of "dedicated" machines are appearing with increasingly greater strengths. Another area of growing popularity is designing a chess program which is more powerful (i.e., a better player) than other chess programs. Two powerful chess programs are now available for the 16K ZX81: *ZX81 CHESS* by Micro-Gen and *ZX CHESS II* by Artic Computing.

Both programs are supplied on cassette with detailed instructions. *ZX81 CHESS* has six levels of play; *ZX CHESS II*, seven. Both games set up a board and use the standard notation with rows 1 to 8 going up and A to F going left to right. *ZX CHESS II* also shows the letters of the columns and the numbers of the rows on the screen for quick reference when entering a move. The 24x24 board of *ZX CHESS II* is somewhat easier to use than the 16x16 board of *ZX81 CHESS*. The pieces are represented as follows: K King, Q = Queen, R = Rook, B = Bishop, N = Knight and I = Pawn. Black pieces are shown as black on white and white pieces as white on black.

Martin Wren-Hilton, 4 Little Poulton Lane, Poulton-le-Fylde, Blackpool FY6 7ET, U.K.

Entering your move is simple on both programs. For example, to move a piece from position E2 to E4 you would enter E2-E4 on *ZX CHESS* and E2E4 on *ZX CHESS II*.

(Continued on p. 84.)

Figure 1: A Game between ZX81 Chess and ZX Chess II

	ZX81 Chess	ZX Chess II
01	D2-D4	G8-F6
02	B1-C3	D7-D5
03	C1-F4	C8-F5
04	G1-F3	E7-E6
05	F4-G5	B8-D7
06	A2-A4	F8-D6
07	H2-H4	E8-G8
08	E2-E3	H7-H6
09	G5XF6	D8XF6
10	F1-D3	F5XD3
11	C2XD3	F6-F5
12	E1-G1	C7-C6
13	F1-E1	A8-C8
14	A4-A5	F8-E8
15	A5-A6	B7-B6
16	G2-G3	B6-B5
17	G1-G2	B5-B4
18	C3-E2	H6-H5
19	E1-H1	D7-F6
20	D1-C2	F6-D7
21	B2-B3	C6-C5
22	E2-F4	C5XD4
23	C2-E2	D4XE3
24	E2XE3	D6XF4
25	E3XF4	F5XD3
26	F4XB4	D7-C5
27	B4-D2	D3XB3
28	D2-G5	G7-G6
29	H1-B1	B3-D3
30	B1-D1	D3-C4
31	D1-D4	C4-B5
32	D4-F4	C5XA6
33	F4-A4	A6-B4
34	A4XA7	B4-C2
35	A1-A5	B5-B4
36	A5-A4	B4-C5
37	A7-A5	C5-C3
38	A5-A7	C8-C4
39	A4XC4	D5XC4
40	F3-E5	C2-E1
41	G2-G1	C3XE5
42	G5XE5	E1-F3
43	G1-F1	F3XE5
44	A7-A5	E5-D7
45	F1-G2	C4-C3
46	A5-G5	C3-C2
47	G5XG6	F7XG6
48	F2-F3	C2-C1
49	G2-F2	C1-D2
50	F2-G1	D2-E3
51	G1-G2	E3-E2
52	G2-H3	E2XF3
53	H3-H2	G8-H7
54	G3-G4	F3XG4
55	H2-H1	G4-H3
56	H1-G1	H3XH4
57	G1-G2	H4-F4
58	G2-H3	F4-G5
59	H3-H2	H5-H4
60	H2-H1	H4-H3
61	H1-H2	G5-G2

House of Horrors

Douglas Duchene

You are trapped in the dreaded "House of Horrors." Naturally it is filled with monsters, mummies, skeletons, and strange creatures. Secret passages and mysterious rooms confront you with danger and yet offer the only way out. Your goal is to escape from the house alive.

As you move through the rooms, you find various items to help you survive, but you do not know exactly what they will be. So you must depend upon your wits, memory, and logic to escape.

The full House of Horrors program requires somewhat over 2K RAM. As a result, it is split into two sections. Type in Listing 1 and SAVE it. Do not kill the program, but enter the changes in Listing 2 and SAVE the program again. Now LOAD Listing 1 from your tape and RUN it. This part of House of Horrors fits into 2K RAM. It can be played as a game in itself for those who have only 2K RAM, and it is a segment of the game for those who have enough memory for the lower level. When the prompt "READY CASSETTE" appears on the screen, you have reached the end of the game if you have only 2K RAM.

However, if you have more RAM, set the tape at the beginning of Listing 2, hit NEWLINE, and press the play button on your tape recorder. When the LOADing is finished, press RUN and NEWLINE to continue your efforts to escape.

While the program was written for the 4K ROM, it should not be difficult to translate to 8K ROM. This will require changing the PEEK addresses, the array subscripts, some of the character codes, logical expressions, and the TL$ function, e.g., 310 would become LET R$=R$(2 TO).

For users with enough memory the game can be made more complex by increasing the number of rooms and items available.

Douglas Duchene, Lot 59 Gatewood, Greenwood, SC 29646.

Listing 1. The House of Horrors (Upper Level).

```
  10 REM 172863OUTSIDE,KITCHEN,B
AR,LIVING ROOM,DINING ROOM,PIT,L
IBRARY,BEDROOM,HALL,KNIFE,SCROLL
,WINE,KEY,BOOK,ROPE,GO RUNWALCLI
JUMGETTAKDROLEALOOOPEREADRIINVSH
A
  20 DIM I(5)
  30 FOR J=0 TO 5
  40 LET I(J)=PEEK(J+16427)-28
  50 NEXT J
  60 PRINT "HOUSE OF HORRORS"
  70 PRINT
  80 LET R=0
  90 PRINT "YOU ARE ";
 100 IF R THEN PRINT "AT THE ";
 110 LET X=7
 120 LET Q=R
 122 LET P=16432
 124 GO SUB 9000
 130 PRINT
 140 PRINT "ITEMS HERE:"
 145 LET F=0
 150 FOR Q=0 TO 5
 160 LET P=16501
 165 LET Z=R
 170 LET X=5
 175 IF F=1 THEN LET Z=0
 180 IF I(Q)=Z THEN GO SUB 9000
 190 IF I(Q)=Z THEN PRINT
 200 NEXT Q
 210 PRINT ":"
 220 INPUT R$
 230 CLS
 240 LET P=16534
 250 FOR J=1 TO 15
 260 IF CODE(R$)=PEEK(P) AND COD
E(TL$(R$))=PEEK(P+1) AND CODE(TL
$(TL$(R$)))=PEEK(P+2) THEN GO TO
 310
 270 LET P=P+3
 280 NEXT J
 290 PRINT "I DONT UNDERSTAND"
 300 GO TO 210
 310 LET R$=TL$(R$)
 320 IF R$="" OR CODE(R$)=0 THEN
 GO TO 330
 325 GO TO 310
 330 LET R$=TL$(R$)
 340 GO TO (J+3)*100
 400 LET Z=1
 410 IF R$="N" OR R$="S" THEN LE
T Z=3
 420 IF R$="W" OR R$="N" THEN LE
T Z=Z*-1
 430 IF R$="N" OR R$="S" OR R$="
E" OR R$="W" THEN GO TO 460
 440 PRINT "N:S:E:W"
 450 GO TO 210
 460 IF R+Z<9 AND R+Z>0 THEN GO
TO 490
 470 PRINT "THERE IS NO WAY TO G
O ";R$
 480 GO TO 210
 490 LET R=R+Z
 495 GO TO 90
 800 GO TO 400
 900 GO SUB 1900
 905 IF NOT I(J)=R THEN GO TO 19
70
 910 LET I(J)=0
 920 PRINT "OK."
 930 GO TO 210
1000 GO TO 900
1100 GO SUB 1900
1110 IF NOT I(J)=0 THEN GO TO 21
0
1115 LET I(J)=R
1120 GO TO 920
1200 GO TO 1100
1300 GO TO 90
1400 PRINT "I CANT"
1410 GO TO 210
1500 IF R$="SCROLL" OR R$="BOOK"
 THEN GO TO 1510
```

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sinclair

```
1505 GO TO 1400
1510 IF R$="SCROLL" AND I(1)=0 T
HEN PRINT "IT SAYS ESCAPE BY THE
 PIT"
1520 IF R$="BOOK" AND I(4)=0 THE
N PRINT "IT SAYS MAGIC WORD (SHA
ZAM)"
1530 IF (R$="SCROLL" AND I(1)=0)
 OR (R$="BOOK" AND I(4)=0) THEN
GO TO 210
1540 PRINT "YOU DONT HAVE IT"
1550 GO TO 210
1600 IF I(2)>0 THEN GO TO 1540
1610 IF R$="WINE" THEN GO TO 200
0
1620 PRINT "YOU CANT DRINK ";R$
1630 GO TO 210
1700 PRINT "YOU ARE CARRYING:"
1710 LET F=1
1720 GO TO 150
1800 PRINT "POOF YOU APPEAR IN T
HE PIT"
1810 PRINT "READY CASSETTE?"
1820 INPUT R$
1830 LOAD
1900 LET P=16502
1910 FOR J=0 TO 5
1920 IF CODE(R$)=PEEK(P) AND COD
E(TL$(R$))=PEEK(P+1) THEN RETURN

1930 LET P=P+1
1940 IF NOT PEEK(P)=216 THEN GO
TO 1930
1950 LET P=P+1
1960 NEXT J
1970 PRINT "I SEE NO ";R$;" HERE
"
1980 GO TO 210
2000 PRINT "IT WAS POISON"
2010 PRINT "YOU ARE DEAD"
2020 STOP
9000 FOR J=0 TO X
9010 IF J=Q THEN GO TO 9050
9020 LET P=P+1
9030 IF NOT PEEK(P)=216 THEN GO
TO 9020
9040 NEXT J
9050 LET P=P+1
9060 IF PEEK(P)=216 THEN RETURN
9070 PRINT CHR$(PEEK(P));
9080 GO TO 9050
```

Listing 2. The House of Horrors (Lower Level Extension).

```
  10 REM 137637,PIT PASSAGE,CRYP
T,MAZE,TUNNEL,EMPTY ROOM,TREASUR
E ROOM,LAVA PIT,SWORD,KEY,CHEST,
DOOR,MUMMY,SKELETON,GO RUNWALCLI
JUMGETTAKDROLEALOOOPEKILXXXINVXX
X
  60 PRINT "ALL YOUR ITEMS ARE G
ONE"
  80 LET R=1
  90 IF R=8 THEN GO TO 2000
  91 PRINT "YOU ARE#";
 110 LET X=8
 122 LET P=16432
 160 LET P=16497
 240 LET P=16534
 332 IF NOT J=12 AND ((R=3 AND I
(4)>0) OR (I(5)>5 AND R=7)) THEN
 GO TO 350
 350 PRINT "MONSTER WONT LET ME"
 360 GO TO 216
 908 IF J>2 THEN GO TO 1130
1130 PRINT "ARE YOU CRAZY?"
1140 GO TO 210
1470 IF R$="DOOR" AND I(1)=0 THE
N GO TO 3000
1480 IF R$="DOOR" OR R$="CHEST"
AND I(1)>0 THEN PRINT "I CANT"
1490 IF R$="CHEST" AND I(1)=0 TH
EN PRINT "ITS EMPTY"
1495 GO TO 210
1500 IF R$="ME" THEN GO TO 2010
1505 IF I(0)>0 THEN GO TO 1580
1510 IF R=3 AND R$="MUMMY" THEN
LET I(4)=-1
1520 IF R=7 AND R$="SKELETON" TH
EN LET I(5)=-1
1530 GO TO 210
1580 PRINT "WITH WHAT MY HANDS?"
1585 PRINT "IT ATTACKED YOU"
1590 GO TO 2010
1900 LET P=16498
2000 PRINT "YOU FELL IN"
3000 PRINT "YOU HAVE ESCAPED"
3010 STOP
```

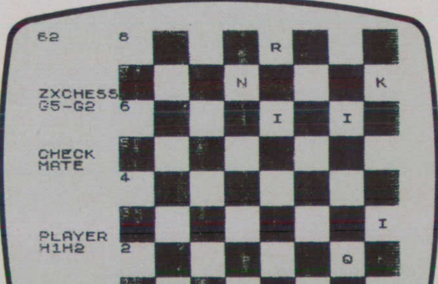
ZX Chess vs. ZX Chess II, Continued...

Both games make use of the En Passant privilege and display the move as PXPEP (pawn exchange pawn, En Passant). Castling is shown as 0-0 or 0-0-0 depending on the side. If you want to castle, you must enter the king's move. You cannot castle out of check, and both programs stop and report invalid moves.

Both allow you to change sides, adjust the level of play, and alter some of the pieces half way through the game.

There are some differences. *ZX CHESS II* allows you to save the present board set-up on cassette, to COPY the screen onto the printer, and to print all the moves that have taken place in that game on the printer. On the higher levels you can even ask it to recommend your next move.

As a test to see which was the better chess player, I decided to pit them against each other. I chose level two on both. On this level *ZX81 CHESS* takes about a minute to decide its move while *ZX CHESS II* takes about forty seconds. A toss of a coin decided that *ZX81 CHESS* should go first. Chess enthusiasts will enjoy analyzing the match move by move. The final result was that *ZX CHESS II* won convincingly, with a Queen, a Rook, a Knight and two Pawn advantage! The final position of the pieces is shown in Figure 1.



Both games have levels for all players from beginner to postal chess. *ZX CHESS II* is clearly a better player and has more features than *ZX81 CHESS*, but it does cost £5-00 more. If you have a QS Character Board, there is a modified version of *ZX CHESS II* which shows real full-size pieces graphically, and very impressive it is, too.

4K ROM; 1K RAM
8K ROM; 2K RAM

A Mouthful for Every Occasion *Don R. Day*

You can call up sensational headlines, forceful commands, whimsical statements, ageless wisdom, and irrelevant nonsense all at the push of a key on your Sinclair computer with the Mouthful program.

What the Program Does

Mouthful is a simple text manipulation program based on the old game of drawing words randomly from a list of assorted words. Strung together, the words make up an unpredictable and often hilarious phrase or saying.

By using the Sinclair computer in a unique way, Mouthful plays this old game in a new way. The program chooses a word from each of the three word lists (see Tables 1, 2, and 3) and prints the resulting phrase on your TV screen. You can generate new phrases as often as you please by pressing NEWLINE.

Don R. Day, 980 West McFie, Las Cruces, NM 88001.

How to Use the Program

The program for Mouthful is in Listing 1. Type it into the computer carefully.

To begin the operation of the program, type GO TO 20 and hit NEWLINE. If the program is running properly, a string prompt ("🄻") will appear in the upper left corner of the screen.

Now comes the big decision: What list will produce the phrase you want? Select Table 1 for oddball headlines, Table 2 for zany slogans, Table 3 for high-sounding

Listing 1. Mouthful (4K ROM).

```
 10 GO TO 1ØØ
 20 DIM A(15Ø)
 30 INPUT A$
 40 FOR N=Ø TO 149
 50 LET A(N)=CODE(A$)
 60 LET A$=TL$(A$)
 70 NEXT N
100 CLS
110 PRINT "PRESS N/L TO GENERAT
E PHRASE"
120 INPUT A$
130 PRINT
140 PRINT
150 PRINT
160 PRINT
170 LET N=Ø
180 GO SUB 3ØØ
190 PRINT "#";
200 LET N=1
210 GO SUB 3ØØ
220 PRINT "#";
230 LET N=2
240 GO SUB 3ØØ
250 PRINT
260 PRINT ,"AGAIN? (Y/N)"
270 INPUT A$
280 IF NOT A$="N" THEN GO TO 1Ø
Ø
290 STOP
300 LET I=RND(4)-1
310 FOR M=Ø TO 9
320 PRINT CHR$(A((N*4Ø+I*1Ø)+M)
);
330 NEXT M
340 RETURN
```

utterances known as aphorisms (e.g., Necessity is the mother of invention).

Type in the list you have selected. Be careful to observe the spaces needed to pad the words into a ten character field. Press NEWLINE after the last word. This stores the words in a single array with proper spacing for random selection. Note that using Table 3 requires some program changes before you type in the list. The screen will go blank for a moment as the ZX80 does its prestidigitation.

The prompt in line 110 will appear and all you need to do is follow the prompts.

You can make up your own lists for the Mouthful program. The list must have exactly 15 words. No word can be longer than 10 letters, and, if the word is shorter, add spaces to fill out to 10 characters.

After you SAVE a program, use GO TO 100 and NEWLINE to begin execution of the program. *Do not use* RUN and NEWLINE or you will lose your list.

The program can be changed to use longer lists if you have more memory. Lists of 30 words or even more can be entered if array A (line 20) is made larger and the limit of I (line 300) is increased.

Table 1. Wacky Headlines.

```
#COMPUTER#
BANK#CLERK
GOVERNMENT
#COMMITTEE
PROSECUTOR
GENERATES#
NABBED#FOR
ELIMINATES
RECOMMENDS
#CONDEMNS#
HEADLINES#
EXTORTION#
EFFICIENCY
MODERATION
PRISONERS#
```

Table 2. "Yes, sir!" Slogans.

```
##CONSUME#
OBLITERATE
#ADVERTISE
##REWARD##
##WELCOME#
HEALTHFUL#
#MENACING#
GANGRENOUS
#LAVENDER#
HONORABLE#
VEGETABLES
INTRUDERS#
HORSEFLESH
BEHAVIOR##
#VISITORS#
```

Table 3. Words of Wisdom.

For Table 3 change Listing 1 as follows:

```
190 PRINT "#IS THE";
220 PRINT "#OF#"
```

```
##BEAUTY##
##AVARICE#
#NECESSITY
##HONESTY#
##COURAGE#
##SCOURGE#
INSTIGATOR
##REWARD##
#BLESSING#
#LOATHING#
INVENTION#
HUMANITY##
##APATHY##
DEDICATION
#AMBITION#
```

How the Program Works

When you press NEWLINE after typing in the list, Mouthful converts the characters into code equivalents which are stored in array A. The trick to breaking this array into three separate lists lies in manipulating the index variable N. This is done by using a multiplier to force N to "see" only that part of the array you want it to. On the first call for a word, the loop index N is set to 0, and a random number is assigned to I. Thus, if I is 3, then the word chosen begins at 0*40 plus 3*10, or at A(30). On the second call for a word, N is set to 1 and I is randomly reassigned. Thus, if I is 5, then the word begins at 1*40 plus 5*10, or at A(90). A third call prints out a random third word by the same technique, and the phrase is finished.

Notes

The following line notes point out some of the program features.

20-70: Load the word lists into the program as a single variable, A$.

100: Starts main portion of program; return point from line 280.

130-160: Help format display.

180, 210, 240: Calls for the random words.

290: End of main portion.

300: Begins subroutine for word selection and printing.

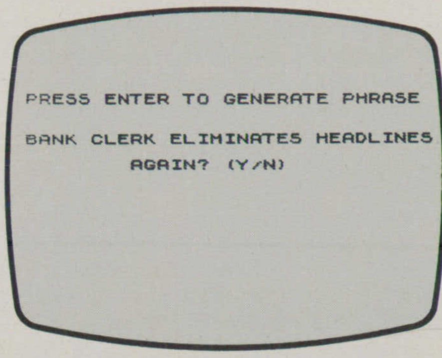
340: Return to main program.

8K ROM Changes

Listing 2 gives the translation for the 8K ROM.

The 8K program can also be made to run continuously by deleting lines 110 to 290 in Listing 2 and substituting lines 110 to 290 in Listing 3.

The 8K ROM version requires over 1K RAM to run as shown; however, the continuously running version can be squeezed into 1K RAM by shortening array A to about 90 elements and adjusting line 320. Short words can be used to maintain the variety of phrasing.



So . . .

Set this program up and have it running at your next party. Your popularity (or perhaps even your notoriety) will never be the same again!

Listing 2. 8K ROM.

```
  10 GOTO 100
  20 DIM A(150)
  30 INPUT A$
  40 FOR N=1 TO 150
  50 LET A(N)=CODE A$
  60 LET A$=A$(2 TO )
  70 NEXT N
 100 CLS
 110 PRINT "PRESS ENTER TO GENER
ATE PHRASE"
 120 INPUT A$
 130 PRINT
 140 PRINT
 170 FOR N=0 TO 2
 180 GOSUB 300
 190 PRINT " ";
 200 NEXT N
 210 PRINT
 260 PRINT TAB 8;"AGAIN? (Y/N)"
 270 INPUT A$
 280 IF NOT A$="N" THEN GOTO 100
 290 STOP
 300 LET I=INT (RND*4)+1
 310 FOR M=0 TO 9
 320 PRINT CHR$ (A((N*40+I*10)+M
-9));
 330 NEXT M
 340 RETURN
```

Listing 3. Lines for 8K ROM Continuous Running.

```
100 CLS
110 PRINT
170 FOR N=0 TO 2
180 GOSUB 300
190 PRINT " ";
200 NEXT N
210 PAUSE 120
290 GOTO 100
```

hardware tips

Some MicroAce Hardware Peculiarities

Irving Chaiet

Problem 1: Keyboard Entry

If your MicroAce will not accept keyboard entries or will accept some, but not all, the most likely hardware problem is a defective IC U11, a 74LS365.

The solution is to replace it. You *must know* that the replacement part (either a new 74LS365 original part or a substitute 74LS367) is a good working part, i.e., it has been tried in a working MicroAce and it works perfectly. I had ordered six 74LS365s from one source, and none worked properly. Even the replacements did not work. Then I ordered from Jameco three types (3-SN74365N, 3-74LS365, and 3-DM9085N which are equivalent made by National Semiconductor). All of these worked fine.

Sometimes IC19, a 74LS04, would not allow the computer to accept the shift key entries of + (-) >. Changing the IC19, the 74LS04, seemed to correct the problem.

Problem 2: Cursor Flicker

If your K cursor flickers or if the LS display flickers when the LET command is keyed in, the problem may be a defective IC U24, a 74LS74. The C12, a 47PF capacitor, could also be at fault. A good substitute for the latter is a 100PF capacitor.

Spare Chips

Since the LS series of chips used in the MicroAce is not expensive, I suggest having a spare set of known good chips on hand. Though you might never have to use them, the assurance of being able to plug in a known good chip balances off the possible frustration of time delay and expense in sending the instrument out for repair.

Here is a list of the chips to have on hand: 1-74LS00, 1-74LS04, 1-74LS05, 1-74LS10, 1-74LS32, 1-74LS74, 1-74LS86, 1-74LS93, 1-74LS157, 1-74LS165, 2-74LS365 or 74LS367 or plain 74365, 1-74LS373.

Note: be very careful to plug in the chips properly. Pin 1 of the chip must correspond to socket 1. Also be sure to prevent static discharges of your body to the computer.

Irving Chaiet, 25 Cherry Hill Rd., New Paltz, NY 12561.

References for Troubleshooting

The following articles on general hardware background and on hardware problems may be of further help.

SYNC

"Adding an LED Load Monitor to the ZX80 (MicroAce)," (1:1, p. 38).

"Four Tips for MicroAce Owners," (1:2, p. 5).

"Using the MicroAce with Sinclair Accessories," (1:2, p. 10).

"First Aid for Your Keyboard," (1:3, p. 3).

"Key Click Generator," (1:3, p. 40).

"The ZX80 Keyboard," (1:3, p. 42).

"A Parallel Interface for the ZX80/MicroAce Computer," (1:4, p. 38).

"Thick Black Bars," (1:6, p. 2).

"Cecil Bridges LED Load Monitor," (1:6, p. 2).

"Experiments in Memory and I/O Expansion," (1:6, p. 20).

"Hardware Helpers," (2:1, p. 28).

"4K/8K ROMs in One ZX80," (2:2, p. 40).

"Getting Loaded," (2:2, p. 41).

"Two-Switch Human Interface for the Communicative Impaired," (2:3, p. 23).

"Keyboard/System Conversion: The First 40/1 Keys," (2:3, p. 28).

Syntax

"8K ROM Modification," (2:4, p. 2).

"ZZZap! NS74LS365," (2:4, p. 6).

"Erratic Keyboard Entries," (2:4, p. 7).

"All Purpose Beeper," (2:6, p. 4).

"Pull-up Resistors—Keyboard," (2:8, p. 8).

"ZX80 Logic States of IC's," (2:9, p. 2).

"Video Sync Information and Tape Recording Loading Solutions," (2:9, p. 11).

"Trouble Shooting—The Effect of Removal of Each Chip from the Computer (incl. chart of equivalent ZX80/MicroAce IC numbers)," (2:10, p. 3).

"Power Plug Blinking Characters," (2:10, p. 9).

"SABRE Info on EPROM," (2:11, p. 1).

"Improve Video Driver," (2:12, p. 3).

Byte Magazine

"Memory Expansion for the ZX80," (Jan. 1982, p. 216).

"Add Full Size Keyboard," (Mar. 1982, p. 256).

"Adding a Reset Key," (Mar. 1982, p. 256).

8K ROM Updates

In the first issues of *SYNC* the programs were all for the 4K ROM. When the 8K ROM became available, we tried wherever possible to provide listings for both ROMs. Since we have had requests from readers for updated versions of some of the programs we published earlier, we will include these from time to time.

Translated to 8K ROM by James Grosjean, 50 Kings Rd., Chatham, NJ 07928.

Hurkle

Laura McLauglin

The Hurkle is hiding deep in the forest and you must find it by logical deduction. Type in the program, hit RUN and ENTER. The prompts will call for the input of two coordinates (X,Y) corresponding to a point on a 10x10 grid. The computer will then tell you in which direction the Hurkle is hiding. Again you enter a new set of coordinates and continue until you have found the Hurkle or used up your five guesses. The program fits in 1K RAM. With sufficient RAM, Hurkle could be expanded to show the grid on the screen and record your entries.

```
 1 CLS
 2 LET A=INT (RND*10)+1
 4 LET B=INT (RND*10)+1
 6 FOR K=1 TO 5
 8 PRINT "GUESS NUMBER ";K
10 PRINT "X COORD?"
12 INPUT X
14 PRINT "Y COORD?"
16 INPUT Y
18 IF ABS (X-A)+ABS (Y-B)=0 TH
EN GOTO 40
20 CLS
22 PRINT "X=";X;" Y=";Y;" ";
24 GOSUB 50
26 NEXT K
30 PRINT "SORRY, THAT IS 5 GUE
SSES."
32 PRINT "PLAY AGAIN?"
34 INPUT A$
36 IF NOT CODE A$=62 THEN STOP
38 RUN
40 PRINT "YOU FOUND HIM IN ";K
" GUESSES."
42 GOTO 32
50 PRINT "GO ";
52 IF Y=B THEN GOTO 62
54 IF Y<B THEN GOTO 60
56 PRINT "SOUTH";
58 GOTO 62
60 PRINT "NORTH";
62 IF X=A THEN GOTO 72
64 IF X<A THEN GOTO 70
66 PRINT "WEST"
68 GOTO 72
70 PRINT "EAST"
72 PRINT
74 RETURN
```

Castle Doors

Weldon J. Horton, Ph.D.

Castle Doors is an adventure game that presents a new challenge with each playing and easy adjustment of the difficulty level. The object is to defeat the wizard.

Type in the program, hit RUN, and ENTER. The display will show your strength and ask whether you want to open a door or fight the wizard. The display will continue to confront you with options which will either use up your strength or add to your strength. When you feel your strength is sufficient, you may take on the wizard.

The variables in lines 26-34 may be changed to provide different challenge levels.

```
  2 PRINT
  4 PRINT "WELCOME TO CASTLE DO
ORS"
  8 LET B=RND*300
 10 LET C=INT (RND*50)+1
 12 GOSUB 200
 22 PRINT "4: OPEN A DOOR  5: F
IGHT WIZARD"
 26 LET D=INT (RND*8)+1
 28 LET A=0
 30 LET E=RND*50+1
 32 LET F=INT (RND*100)
 34 LET G=INT (RND*25)+1
 38 INPUT O
 40 CLS
 41 IF O=5 THEN GOTO 176
 42 LET A=INT (RND*(D*10+10))+1
 43 GOTO (D+21)*2
 44 LET A$="CYCLOPS"
 45 GOTO 60
 46 LET A$="WITCH"
 47 GOTO 60
 48 LET A$="DRAGON"
 49 GOTO 60
 50 LET A$="GARGOYLE"
 51 GOTO 60
 52 LET A$="ZOMBIE"
 53 GOTO 60
 58 GOTO 160
 60 PRINT
 62 PRINT
 70 PRINT "YOUR OPPONENT IS A "
;A$
 72 GOSUB 200
 80 PRINT "ENTER   1: FIGHT 2:
BRIBE 3: RUN"
 84 INPUT N
 86 CLS
 88 IF N=2 THEN GOTO 124
 90 IF N=3 THEN GOTO 148
 92 IF C<A THEN GOTO 176
 94 GOSUB 200
104 PRINT "HOW MUCH STRENGTH WI
LL YOU USE?"
106 INPUT Q
108 CLS
109 PRINT
110 PRINT
112 IF Q>C THEN GOTO 94
114 IF Q>=A THEN LET C=C+G
116 IF Q>=A THEN PRINT "YOU WIN
 BRAVE ADVENTURER"
118 IF Q<A THEN LET C=C-Q
120 IF Q<A THEN PRINT "YOU LOSE
TO THE ";A$
122 GOTO 12
124 GOSUB 200
132 PRINT "SIZE OF BRIBE?"
134 INPUT P
136 CLS
138 IF P>=E THEN LET C=C-P+G
140 IF P>=E THEN PRINT "ACCEPTE
D"
142 IF P<E THEN PRINT "REFUSED"
144 IF P<E THEN GOTO 60
146 GOTO 12
148 PRINT
150 PRINT
152 IF F=7 THEN GOTO 176
154 PRINT "YOU GOT AWAY"
156 LET C=C-INT (RND*15)+1
158 GOTO 12
160 PRINT
162 PRINT
164 IF D=6 THEN PRINT "SAVE PRI
NCESS AND GAIN 50 POINTS"
166 IF D=6 THEN LET C=C+50
168 IF D=7 THEN PRINT "A FAIRY
GIVES YOU A POTION WHICHDOUBLES
YOUR STRENGTH"
170 IF D=7 THEN LET C=C*2
172 IF D=8 THEN PRINT "A GIANT
BAT TAKES YOU TO ANOTHERDOOR"
174 GOTO 12
176 PRINT
178 PRINT
180 IF C>=B THEN PRINT "YOU KIL
LED THE WIZARD-YOU WIN"
182 IF C<B OR C<A OR C<1 OR F=7
 THEN PRINT "YOU FOUGHT WELL BUT
 LOST-GAME   OVER"
184 STOP
200 PRINT
201 PRINT
202 PRINT "YOUR STRENGTH IS ";C
203 PRINT
204 PRINT
205 IF C<1 THEN GOTO 182
206 RETURN
```

Nicomachus

David Ahl

Type in the program, press RUN, and ENTER. The prompts on the screen will tell you what to do. Type in your entry followed by ENTER. The computer will then figure out your number by logical deduction. The program fits in 1K RAM, and runs better in SLOW mode.

```
  10 LET A$="WHEN DIVIDED BY "
  20 LET B$=" ITS REMAINDER IS?
"
  30 PRINT "THINK OF A NUMBER FR
OM 1 TO 100."
  40 PRINT A$;3;B$;
  50 INPUT A
  60 PRINT A
  70 PRINT A$;5;B$;
  80 INPUT B
  90 PRINT B
 100 PRINT A$;7;B$;
 110 INPUT C
 120 PRINT C
 130 PRINT "LET ME THINK A MOMEN
T..."
 140 LET Y=70*A+21*B+15*C
 150 IF Y<106 THEN GOTO 180
 160 LET Y=Y-105
 170 GOTO 150
 180 PRINT "YOUR NUMBER WAS ";Y;
", RIGHT?"
 190 INPUT A$
 210 IF CODE A$=62 THEN PRINT "H
OW ABOUT THAT."
 220 IF CODE A$=51 THEN PRINT "I
 THINK YOU MISCALCULATED."
 230 PRINT "WANT TO TRY ANOTHER?
(Y/N)"
 240 INPUT D
 250 CLS
 260 RUN
```

Widget

Gary McGath

To play Widget type in the program, press RUN and ENTER. The screen prompts call for you to make executive decisions. Type in your decision and hit ENTER. After computing your decision, your ZX81 will post your new financial position and the number of many months you have been in business. The object of Widget is to avoid bankruptcy. The program requires a 2K machine.

```
   5 RAND
   6 LET Z=1
  10 LET P=1
  20 LET M=900
  30 LET I=0
  40 LET S=10
 100 CLS
 110 PRINT "MONTH  ";Z
 120 LET Z=Z+1
 300 PRINT "YOU HAVE";TAB 16;"$"
;M;"00"
 310 PRINT TAB 8;P;" PLANTS"
 320 PRINT TAB 8;I;"00 WIDGETS"
 330 PRINT "LAST MONTH YOU SOLD
";S;"00"
 350 IF M<1000 THEN GOTO 410
 360 PRINT "BUY A PLANT?"
 370 INPUT Y$
 380 IF Y$<>"Y" THEN GOTO 410
 390 LET P=P+1
 400 LET M=M-1000
 410 PRINT "AD BUDGET IN 1000S ?
"
 420 INPUT B
 430 IF B*10>M THEN GOTO 420
 440 LET M=M-B*10
 450 PRINT "PRODUCTION IN 100S ?
"
 470 INPUT W
 480 IF W>10*P THEN GOTO 470
 490 LET I=I+W
 500 LET S=INT (S/INT (RND*3+3))
 510 IF B<6 THEN GOTO 550
 520 LET S=S+(B-6)*5
 530 LET B=6
 550 IF B<2 THEN GOTO 600
 560 LET S=S+(B-2)*7
 570 LET B=2
 600 LET S=S+B*8
 610 IF S>I THEN LET S=I
 620 LET M=M+S*10
 630 LET I=I-S
 640 LET M=M-20*P-20
 650 LET M=M-(W-1)*5
 660 IF M>=0 THEN GOTO 100
 800 PRINT "YOU ARE BANKRUPT."
```

resources

The "Resources" column lists new products for Sinclair users. Suppliers and users are invited to send brief product descriptions and details for ordering to: Resources, SYNC, 39 E. Hanover Ave., Morris Plains, NJ 07950.

User Groups

- Kaiserslautern, Germany ZX81 Users Group. Just being started. Contact:
  Tom White
  HG 21st SUPCOM
  ACSRM - IRD
  APO NY 09325
  Phone: 2221-7432

- The Sinclair Users Group of San Diego. For information contact:
  Robert Jorgenson
  3814 Coleman Ave.
  San Diego, CA 92154

User Groups Forming

- Any Portland, Oregon, area users interested in forming a group? Contact:
  J. E. De Groot
  2146 N.W. Johnson St., 108
  Portland, OR 97210

Business/ Household Programs

- *ZX Phone Book.* Holds 720 names with edit functions of ADD, CHANGE, DELETE, and SAVE; search by name or category; can be used for other information. 16K RAM. Hard copy listing with thorough documentation: $4.95
- *Sort-a ZX81.* Collating tool; counts and files thousands of items in up to 29 categories on just 1K RAM; listing and notes show how to use your ZX81 as a home and office tool. Hard copy listing with thorough documentation: $4.95.
  Thomas B. Woods
  PO Box 64
  Jefferson, NH 03583

- *Data Storage and Display System.* Stores up to 60 data points in a file, e.g., stock prices, profit-loss data, experimental data; allows file crunching for plotting; up to 25 files can be saved under user-defined titles; recalled in tabular or graph form; menu lists 9 jobs; expandable with additional cassettes. 8K ROM; 16K RAM. $14.75 plus $1.25 s&h.
  ZX-Panding, Ltd.
  PO Box 25
  Newton, NC 28658

Educational Programs

- *Vocab Builder for the ZX81.* 60 words per cassette; 2 modes; definitions and quiz; for teens and adults. 16K RAM. $9.50.
  Charles Bucher
  132 E. Pasco Lane
  Cocoa Beach, FL 32931

Games

- *ZX81 Bomber.* Drop bombs and two types of missiles on the enemy; graphics; points and percentage; full documentation and instructions. 8K ROM; 1K RAM. Program: $1.00 plus SASE. Cassette: $3 plus $1 s&h.
  Rimas Buntinas
  7440 N. Rockwell
  Chicago, IL 60645

- *Trader Jack.* You are captain of your own trading vessel sailing the South Pacific; buy supplies; fight storms and volcanos; trade your cargo, hopefully for a profit. 8K ROM; 16K RAM. Also ZX81 Monopoly in Spanish, American, or British versions. Each game on cassette: $14.95.
  Savage Software
  PO Box 892
  New Smyrna Beach, FL 32069

- *Pick'em.* Program to attempt to predict outcome of national football league games and even the point spread; accepts information available from most daily newspapers. 8K ROM; 16K RAM. Cassette: $9.95 plus $1.50 s&h.
  Stuart Software
  25381-G Alicia Pkwy., Suite 316
  Laguna Hills, CA 92653

- *Mad Dog Tank Blaster.* Mammoth program with routines useful in your own programming. Wild tank moves through grid-like maze blasting all the way; your man must put a mine in its path without getting shot, run over, or blown up by the mine. Hard copy listings with thorough documentation to teach programming. 16K RAM. $6.95.
  Thomas B. Woods
  Box 64
  Jefferson, NH 03583

- Arcade excitement on your 1K or 2K ZX81. All programs have moving graphics; sold as listings. Pickle Man: $2; Tempestuous Battle: $2; ICBM Barrage: $2; Monkey Barrels: $2; Defense Wave: $1.50; Evade: $1; Lander-X: $1.50. Add $0.30 s&h.
  Panero Software
  3309 Lewis Ave.
  Long Beach, CA 90807

- *Game Pack for the ZX81.* Bomber (move the bomb sight over the target, very fast); Missile (destroy the missiles before they hit your spaceship); Auto 3-D (enter 4 numbers; ZX81 will draw tunnels and spirals and much more depending on numbers); Speed Draw (the ZX81 starts a line; control it by the right keys to produce all sorts of pictures). 8K ROM; 1K RAM. All four on one cassette: $5 plus $3 s&h.
  Mark E. Rogers
  553 Melrose Dr.
  LaPlace, LA 70068

- *18 Hole Golf.* Graphics display of each hole, moving ball, 3 types of hazards; 4 player capability; final score card display; 3 different courses. 8K ROM; 16K RAM. Cassette: $10.
  R. Midura
  19 Merrifield St.
  Worcester, MA 01605

Graphics Programs

- Memopak High Resolution Graphics. Contains 2K EPROM monitor, holding full range of graphics subroutines called up by USR or machine code; gives 192 x 248 pixels. Video pages: each requires about 6.5K RAM; memory and bit mapped; can be located anywhere in available RAM. $149.95.
  Memotech
  7550 West Yale Ave., Suite 200
  Denver, CO 80227

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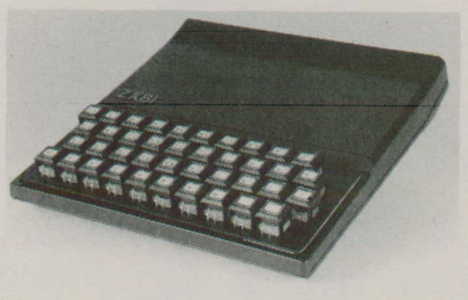

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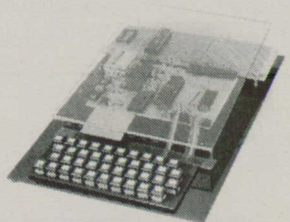

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- Programs for the ZX81. Games, business, household, statistics, cards, aids, horse racing, and other general items. Free catalog.
  UAS
  PO Box 612
  Haddonfield, NJ 08033

- Game, utility, household programs. 16K RAM/1K RAM. For details send SASE (postage $.40).
  Gampper
  Zollamtstrasse 52
  675 Kaiserslautern
  West Germany

- *The Sinclair Computer Family Sourcebook.* Lists over 500 programs, books, accessories from over 80 manufacturers. $4.95 plus $1.25 s&h (add 4% tax in Virginia).
  Atlantic Computer Products
  PO Box 936
  Norfolk, VA 23501

- Howard Hein is compiling a directory of services and supplies for the Timex/Sinclair 1000. He invites readers to supply information on: hardware and software suppliers; hardware and software projects (including listings); user groups; newsletters; reviews in magazines and books; suppliers of training; shows and festivals. Submissions and comments to:
  Howard Hein
  33 Oak Lane
  Mt. Lakes, NJ 07046

RAM Expansion

- Memopak 16K RAM. Accepts further memory units plugged in "piggy-back" fashion (Memopak 16K, Memopak 32K, or Sinclair 16K) and other add-on peripherals. $59.95.
- Memopak 32K RAM. Full 32K RAM directly addressable. Accepts Memopak 16K RAM as plug-in. $99.95.
  Memotech
  7550 West Yale Ave., Suite 200
  Denver, CO 80227

Printers

- MW 100 Printer. Available now. Prints on plain paper roll, 1 3/4 inches wide; standard tape and ribbon obtainable at office equipment and electronics stores. For details:
  Mindware, Inc.
  70 Boston Post Rd.
  Wayland, MA 01778
  (617) 358-7175

Interfaces

- Memopak Centronics Parallel Printer Interface. Enables ZX81 to be used with a wide range of dot matrix and daisy-wheel printers. Resident software gives ASCII character set. $94.95.
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- ZX99 Automatic Tape Control. Full software control of up to four tape decks (two for loading; two for saving) to mix and modify files; uses tape for data storage; automatic tape copy; diagnostic information for best recording; RS-232-C interface to connect to any such serial printer using standard ASCII; 2K ROM extends the ZX81 8K ROM and accessed by USR. $150.
  Data-assette
  H.S.W. & S., Inc.
  52 South 3rd St.
  Oxford, PA 19363
  (215) 932-3626

Keyboards

- ZX80/1 Keyboard. Keytops finger shape molded; characters for the ZX keyboard printed in two colors on keytops as per your ZX80/1; repeat key; black plastic molded case available (can be purchased separately); 12-inch ribbon cable attached by 15 solder connections; full instructions. $75.
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  (215) 932-3626

- 44 key tactile keyboard; plugs into ZX81 or Timex/Sinclair 1000; all graphics included; EDIT, DELETE, ", and FUNCTION do not require shift. $70 plus $4 s&h (add 4% tax for Massachusetts
  E Z Key
  Suite 75, 711 Southern Artery
  Quincy, MA 02169

- Keyboard overlay. Gives tactile help in making keystroke entry; stops missed keys; speeds program entry; simple to install. $3.95.
  P. Hargrave
  Site V, R.R. 4
  Nanaimo, B.C.
  Canada V9R 5X9

- E-Z Key 44. Hear a click and feel a snap for every key pressed; 4 special keys have electronic control to eliminate need to use shift key (DELETE, EDIT, ", FUNCTION); accesses all graphics and functions; no wiring required; just plug it in; adaptable to ZX80 or Micro-Ace; schematic and instructions. $70 plus $4 s&h (add 4% tax for Massachusetts.
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Hardware Improvements

- ZX81 Improved Heatsink. Prevent system crashes caused by overheating of voltage regulator; no modification of appearance or function of the ZX81 needed; installed in minutes. $10.
  B. Sanzone
  289 Baxter Lane
  Milford, CT 06460

- End edge connector tarnish problems. Electro-plate the fingers with 24 karat gold. $15 plus $3.75 s&h for first item; $10 plus $2.75 for any additional item with the same order. *Do not send* the product you want plated now. Instead send SASE for full details first.
  Matthew Zenkar
  142 Holcroft Rd.
  Rochester, NY 14612

System Expansion

- System expansion kit. Install permanent system utilities such as machine language or service routines in up to 8K memory that is not lost when you reset or turn off your ZX81; compatible with 16K RAM packs. Full details and all components including one 2K HM6116P-3 CMOS RAM: $29.95 plus $1.95 s&h. PC board alone, masked and silkscreened: $15 postpaid. Additional 2K HM6116P-3 (150 ns): $9 each.
  Hunter
  1630 Forest Hills Dr.
  Okemos, MI 48864

Tape Accessories

- Winky Board Cassette Loader/Duplicator Interface. Makes loading easy; includes LED level monitor, earphone eavesdropper and interference filter, circuits for direct copying of any cassette. Kit: $12; assembled and tested unit: $18. U.S. postpaid; overseas: add $2. Free information.
  G. Russell
  RD 1, Box 539
  Centre Hall, PA 16828

- ZX Loading Aid. Circuit detects and shows signal level on two LEDs to enable you to distinguish program, introductory buzz, silence, voice overs; in small black metal box 90x35x30mm with two 3.5mm sockets and two 3.5mm jacks; connects between tape player and computer. 1%9.95 (incl. s&h and VAT); $21. Specify which computer you will use it on.
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  "Hillside" Steep Lane, Findon
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- Chirper module. Gives acoustic feedback on keystrokes as a variable chirp that remains on until the ZX81 is ready for another entry; produces sound while program runs; sounds can be programmed either in Basic or machine code; fits inside ZX81; solder 3 wires. $9.95.
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Video Upgrade

- Video Upgrade Kit. For ZX80 8K ROM; smooth flicker free video; performance is exactly that of the ZX81; easy assembly and installation inside the ZX80. $32.50 plus $2.50 s&h.
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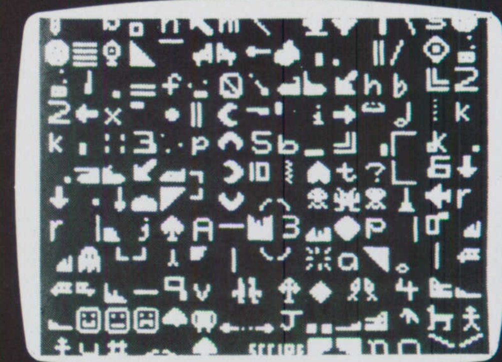

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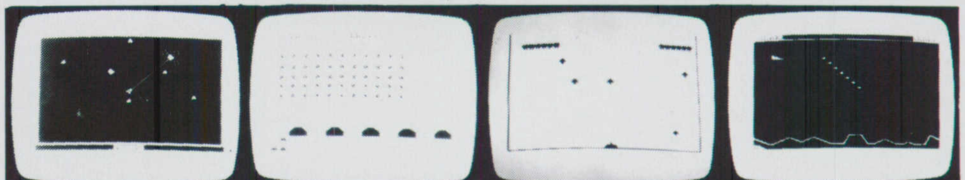

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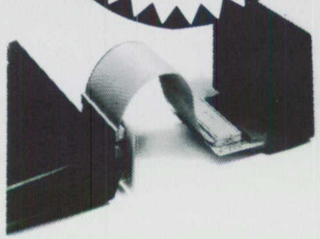

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